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INDEX TO CONTENTS, PAGE 132 ADVERTISERS' INDEX, PAGE 20

KOPPERS

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The most efficient method of carbonizing coal is in KOPPERS OVENS and the best coke and by-products are produced by this process.

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Silk Ribbon Substitute and Braid for Millinery Trade Made From Milkweed and Wood Pulp With the Aid of Gas

Special Burner for Calender Rolls Eliminates Excess Carbon of Previous Method and Prevents Soiling of Goods—Sensitiveness and Small Size of Burners for Fluting Machines a Problem Solved by Gas Company

By S. E. WARDELL

As one of the offshoots of the many hundreds of operations in the great silk industry to which gas has been successfully applied, we find it extensively used in bringing upon the market silk substitutes.

One manufacturing plant, known to the writer, is devoted to producing corded silk braid as used in trimming ladies' hats and dress goods. It has a beautiful satin finish and is made up in as many styles and colors as the real silk, yet is made from the common milkweed plant which we find scattered over various parts of the country. This same product is manufactured into ribbon of practically every size, and is imprinted with artistic, conventional and flowered designs and dyed in every color for use as a substitute for the more expensive silk ribbon. The astonishing strength of its fibrous structure makes it ideal for use in tying up packages while its good looking qualities make it well known in the confectionery trade for use on candy boxes.

The milkweed plant, as many doubtless know, has a pod in which forms a tuft of long silky hairs, which serve, when the pod is ripe, to carry the seeds over the country side when wafted this way and that by the wind. These tufts of cotton or so-called silk are gathered and shipped to the manufacturer, first mentioned, in baled form. Wood pulp is also received in the same manner, and enters into some of the operations.

The first step is that of washing, cleaning and removing of all foreign substances, after which the pulp is fed into spinning and drawing-out machines. This is accomplished by passing the pulp between gas-heated rollers, under hydraulic pressure, which flattens it out into ribbon strands.

It is here that the industrial fuel salesman, Edgar Atherton, of the Public Service Gas Company of New Jersey, gave one particular manufacturer the benefit of his experience. He found that open-flame burners were in use, which created too much carbon and spoiled

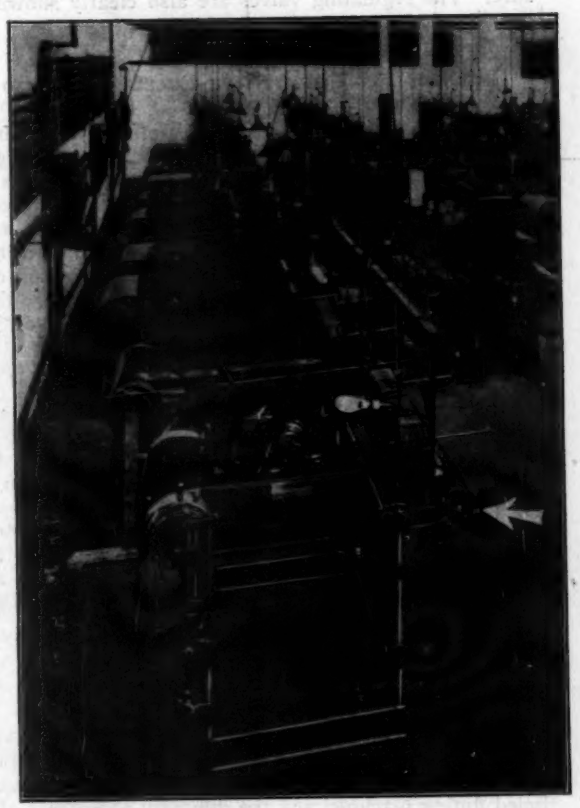


FIG. 2—MACHINE USED IS SIMILAR TO THIS RIBBON CALENDER FINISHING MACHINE—ARROW SHOWS LOCATION OF BURNERS

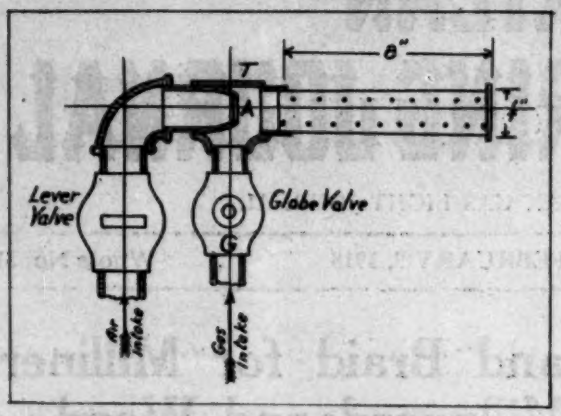


FIG. 1—DIAGRAM SHOWING CONSTRUCTION OF BURNER DEVISED BY GAS COMPANY

much of the work. Accordingly, he devised a burner, as illustrated in Fig. 1, drilled as indicated, which fits inside of the revolving roller, the special feature of this burner being the small size necessary to accomplish the work satisfactorily. A quarter-inch pipe was used, only 8 in. long. Air and gas being supplied on the ratio of 8 to 1, the former at about 1 lb. pressure. The regulating valves are also clearly shown in the diagram.

Burners for Twenty-five Rollers Supplied

As a result of the gas company's efforts along these lines, about twenty-five of these burners are now giving good satisfaction with practically no spoilage of goods. The ribbon strands are then dyed in every conceivable color and split to ordered sizes. After being sized with dextrine to give strength they are dried and finished by gas in a machine similar to the ribbon calender finishing machine, shown in Fig. 2, and are then ready for imprinting. The arrow indicates the position of the gas-heated drying rollers.

Imprinting, Embossing and Drying

Any design, flowered or conventional, desired by the buyer is then etched on copper rolls. The ribbon in passing over these cold rollers, inked in the colors desired, obtains the imprint in the same manner as paper is printed, and then passes over a gas-heated roller for drying purposes. Very excellent embossed effects are obtained by running the strands between heated rollers designed for the purpose.

Braid Machines Also Use Gas

The same pulp pressed to a different thickness and cut to the necessary width is used in the braiding machines. These are built on the style of the old-fashioned fluting machine, and the difficulty arose here also in supplying burners, due to the very small size and sensitiveness necessary on account of the small bore of the roller. After some experimentation the proper result has been obtained, as evidenced by the high satin luster and service giving qualities of the corded braid put out by the manufacturer.

How the Salesman's Personality Often Counts More Than the Prospect List

In talking over the installation with Mr. Atherton, I asked him how he became acquainted with the possibilities offered by this manufacturer. In his answer he told me how the manufacturer was having trouble with his automobile in the street, and how he in stopping a moment to look had suggested a means of alleviating the trouble. He happened to meet the same man again,

FIG. 3—FINISHED PRODUCT IS PRINTED IN VARIED COLORS AND DESIGNS

and asked him how the car was running, and before long the manufacturer invited him to look over his plant. When once on the ground, as an invited guest, he saw the many improvements that were possible, and the manufacturer, remembering the automobile suggestion, told him to go ahead.

The author wishes to thank the Industrial Fuel Department of the Public Service Gas Company for its assistance and the use of the diagrams and photographs.

Difficult to Define Limitations of Gas for Fuel Purposes

Natural gas, by its heat unit quantity, is placed in a class alone, but next to it as an ideal fuel for domestic and for many manufacturing purposes comes artificial gas, states an editorial in the *Public Service Lumen*, published by the Public Service Company of Northern Illinois. Considering it only in its application to the kitchen range, it has no possible rival in the points of cleanliness, economy and quickness. These special qualities have been developed to a high plane by the aid of range manufacturers. They have worked steadily to perfect appliances that secure high efficiency of operation from small consumption of fuel. The history of gas as a fuel for cooking is remarkable. The chapter that is being written on gas in the industrial arts bids fair to be even more interesting.

In hardly more than a year it has overturned old practices and traditions in many kinds of manufacturing and established itself so strongly that in numerous cases entire plants have been converted to its use. In many of these adaptations a bare comparison between the price of gas and that of coal is in favor of the latter. But the extraordinary advantages of gas serve in reality to make it the cheapest of the two. It is not surprising that the gas industry finds it difficult at present to define the limitations of gas fuel.

Gas vs. Its Various Competitors in the Future

W. Newton Booth Outlines Improvements in Gas Manufacturing and Distribution Methods He Expects Will Ensue—Concentrating Production in a Series of Large Stations

W. Newton Booth, of the British Royal Arsenal Gas Department, Woolwich, took occasion, in a paper presented before the London and Southern District Junior Gas Association, to point out some of the lessons the British gas industry has learned from the war and to indicate what, in his opinion, would be the future trend.

The problem of the future, then, for the industry, he pointed out, is inseparably tied up with that of the conservation of coal supplies. Its activities should extend far beyond the present scope of supplying a gaseous fuel in small quantities to a very large number of consumers, largely for purely domestic purposes. They should aim at including also those customers requiring to develop heat on a large scale and for all purposes.

Town's Gas and Some of Its Competitors

For lighting the only serious competitor is electricity, and its position is a strong one.

The prospect of improvement in electric lighting lays chiefly in the reduction in cost of electricity due to more efficient production of power, to which the gas industry will probably largely contribute in the future. As far as the lamps themselves are concerned, the hope of greater efficiencies lays in the increase of filament temperature, and can only be attained either by the discovery of some new material or by increase of pressure in the bulbs, to prevent volatilization; and so far as can be seen at present the increased efficiency to be hoped for will be trifling compared with the saving due to the reduction possible in cost of electric energy.

For heating, the competitors are coal and electricity. Raw coal has the advantage that it is handy and easy of application, and the apparatus required is not costly. Its disadvantages are low efficiency, smoke, dirt and the waste of valuable volatile products. Heating by electricity is in itself an extremely wasteful proceeding. It is no uncommon thing for 4 lb. of coal to be burned for each unit of electricity produced, even in large generating stations.

Taking coal as having a calorific value of 13,000 B.t.u. per pound, this means the expenditure of 52,000 B.t.u. to produce one Board of Trade unit of electricity, which, when again turned into heat, could produce only 3,412 B.t.u., giving an efficiency of under 7 per cent.

The use of electricity for heating can only be defended when the advantages of its application—*e. g.*, for small furnaces requiring exact heat regulation, or when extremely high temperatures were required—quite outweigh the low thermal efficiency; or when the electricity is obtained from a power source which does not involve the destruction of coal.

Power Uses

The competitors of gas for power purposes are electricity, steam, oil and suction gas engines. In this field gas is holding its own, but in the future much depends on the cost at which electric power can be generated for distribution, and there is room for close co-operation between the gas and electric industries in this matter.

It will be very much better for the gas industry to sell large quantities of cheap gas to the electric generating stations for the production of power than to continue to supply smaller quantities to a large number of individual consumers, if such a course were dictated by the economic conditions.

Steam engines are only superior to gas engines when the power required is large—so large, in fact, as to be greater than the capacity of single unit gas engines as now made, while with oil engines the cost of fuel is very much higher than with the average town's gas engine. With regard to suction gas engines, this again is largely a matter of size of unit. In units of over 100 hp. suction gas engines can generally be run for less than those operating on town's gas, unless this is supplied at a cheap rate; but there are certain disadvantages, such as the extra atendance required, extra wear and tear due to impurities in the gas, uncertainty at starting, etc., which make the substitution of town's gas for suction gas an economical proposition if the price of town's gas is brought down to about 50 cents per thousand cubic feet for this purpose.

Heating and Incandescent Lighting

As the staple product of the industry is gas, it is necessary to inquire as to the various properties of a gas which constitute its value for these purposes. For the most part gas heating burners are of the atmospheric type, depending for their action on the injector effect of a jet of gas. Time does not admit of the discussion of the theory of injectors, but the amount of air which might be injected by any gas stream is affected greatly by the size and arrangement of the orifices and passages in the injector tube and burner, and depends also on the density and pressure of the gas supplied to the gas nipple, while the amount of air required is governed by the "comburivity" of the gas, *i. e.*, the ratio of the volumes of gas and air required for complete combustion, and the velocity of the gas stream necessary to prevent firing back, by the composition of the gas, and the degree of aeration of the gas mixture.

The efficiency of the lighting effect of a mantle varies tremendously with the temperature to which it is heated. This temperature naturally depends on the laws which govern the temperature of the flame—*i. e.*, the calorific value of the gas, the heat capacity of its products of combustion, the rate of combustion, and the size of the flame (which governs the amount of heat lost by radiation) and the amount of pre-heat given to the gas mixture before combustion. In an experiment with a No. 1 "Metro" burner tube and nozzle, the temperature being artificially increased about 400 deg. C.—*i. e.*, from an estimated temperature of 1,650 deg. C. to 2,035 deg. C.—the illuminating power of the mantle rose from 45 candle-power to 131 candle-power, and the efficiency from 16-20 candle-power per 100 calories per hour to 38-70 candle-power per 100 calories per hour, or equivalent to 22-17 and 52-65 candle-power per cubic foot per hour of 540 B.t.u. gas.

The value of gas used in gas engines for the production of power depends solely on its calorific power, though a gas can be so rich as to give very considerable

trouble in large engines, due to overheating of the piston and preignition, while a gas of too low a value reduces the capacity of the engine. Any gas which is satisfactory for distribution generally would, however, be good enough for power production.

Two of the most important attributes of any successful service are efficiency and reliability, and it is difficult to say which is the more important. To take the question of efficiency first, as it is probably that on which most of the persuasive arguments of salesmen is based, by far the most important property of gas from the efficiency point of view is calorific intensity, and it should therefore be the aim of the gas engineer to increase the calorific intensity of his main product to the furthest possible limit.

With regard to reliability, the one lesson the war has taught in this direction is the advantage of standardization. The properties which it is important to standardize are calorific value, combustivity, density and pressure, and for each supply district these should remain at a constant value within very narrow limits.

The Future Gas

Very largely the questions involved have reference to the production of the gas. Methods of gas production have changed very much during the present century, and still greater changes, such as are foreshadowed by John West, will undoubtedly be accomplished in the near future. Something of the lessons the war has taught in the scientific heat treatment of metals must be applied to the heat treatment of coal. Subject to the risks which all prophets run, he is of the opinion that the following improvements in methods will be gradually introduced:

(1) The superior heat efficiency of the process due to a form of internal heating of the retorts or other carbonizing chambers, coupled with a large increase in the carbonic oxide and hydrogen constituents of the gas, and the reduction of the inert non-combustibles, which are mere diluents and detracted from the valuable calorific intensity.

(2) The more scientific heat treatment of the volatile portions of the coal, with the object of securing a larger proportion in the form of valuable organic compounds, and the increase in the recovery in marketable form of the combined nitrogen and sulphur of the coal.

When it is remembered that the "thermal efficiency" of coal carbonization as ordinarily practiced is only about 80 per cent; that of the volatile organic compounds, comprising, say, 30 per cent by weight of the coal, only one-sixth is recovered as such, and that more than half of that could not reasonably be considered to be in its most valuable form; that rarely more than 28 lb. of ammonium sulphate is recovered from each ton of coal, this only representing a nitrogen content of 0.31 per cent, about one-fourth of the nitrogen in the coal; that the sulphur recovered in oxide and liquor rarely exceeds 19 lb. per ton of coal, about half that contained in the average coal, it will be seen that there is still considerable room for improvement in their methods.

With regard to the distribution offered, in many cases it would be much cheaper to distribute gas than the corresponding amount of coal, and he looks forward to a day when gas production would tend to be concentrated in a series of large stations, and when long-distance distribution of gas at high pressures to sub-distribution stations feeding existing pipe networks will be the standard method. Before this could come to be the general practice, however, the gas industry will have to displace existing coal-consuming devices by gas appliances. Whatever the developments, however, it must be borne in mind that satisfaction to consumers is the prime factor, and that this can only be given if adequate pressures were maintained at the points of consumption, and these pressures kept at a fairly steady value.

Operating the Rector Gas Heating System

George S. Barrows Traces Steps in Its Development and Points Out Advantages—Its Availability for Business Buildings

A study of the literature of building heating seems to indicate that those who have been interested or employed in the solution of heating problems or the construction or installation of heating equipment generally have devoted their energy to, first, improving the distribution of the heating medium; second, the utilization of the heat from the medium; third, the combining of heating and ventilating which is proper because of their interrelation, declared George S. Barrows, manager of the gas heating department of the General Fire Extinguisher Company, in a paper presented before the American Society of Heating and Ventilating Engineers at New York City in January. This appears true, no matter whether the heating medium be hot air, hot water or steam.

Very little attention has been given to the fuel problem except by the manufacturers of the appliances in which the fuel is consumed, and their endeavors have been principally to increase the efficiency or convenience of their particular apparatus with the old and well-known fuels rather than to develop the utilization of a new fuel. Much study has been made of fuels, but by students of combustion rather than by students of heating. This is a perfectly logical development proceeding, as it does, along the line of least resistance, for a new fuel would not only involve fuel difficulties to be overcome, but would present heat distribution problems similar in character to those of the appliances burning the old fuel, which almost invariably was coal, or, in certain localities, natural gas. A practical heating system employing manufactured gas, but equally satisfactory for natural gas, is, therefore, sufficiently novel to be worthy of careful consideration.

The Era of Natural Gas Heating

When first distributed, natural gas was so plentiful and cheap that it was burned as a substitute for coal in any make-shift burner in the heaters already in use. Natural gas was often piped through lines many miles long and under high pressures so that breaks in the lines occurred from time to time. Except under particularly favorable conditions, the normal supply could not be augmented during cold snaps or at times of similar suddenly increased demand. Increased consumption without increased supply caused such reduction in distribution pressures that the supply was inadequate. Shortages of the supply from one source or another were so frequent that users preferred an inefficient ap-

pliance in which another fuel could be readily substituted, to the more efficient appliance designed solely for gaseous fuel. This choice was the more natural because the gas was usually sold at a rate so low that it cost no more than coal, even when burned inefficiently in coal heaters.

The Trend Towards Manufactured Gas Heating

As nearby gas fields became exhausted and the price of gas was raised to meet the increased cost of production, appliances designed for gas fuel became more common. Unfortunately, however, before their development had passed much beyond the experimental stage, the failures of adequate supply became so frequent that natural gas companies themselves recommended to their consumers that they install only heating appliances in which solid fuel could be used when necessary. This condition, of course, effectually put a stop to the further development of heaters using natural gas as the sole fuel.

For many years manufactured gas has been used widely as fuel for intermittent or auxiliary heat by means of small portable heaters which might be moved from room to room as desired, the connections with the house gas pipes usually being by means of rubber or similar flexible tubing. Frequently when the heater was to be left in one place at all times a solid iron pipe connection was used, but except in case of gas logs or fireplace heaters, appliances when so connected permanently were generally of the portable type. At first these heaters were used in rooms where the regular heating system was insufficient, either during the entire heating season or at times of unusual cold, or because a temperature above the normal was demanded. At times some consumer would depend on such equipment solely for heat, or would, perhaps, install a central heater using gas only as fuel, but such cases were sporadic and due to some local or personal condition.

While gas companies as a class recognized the increase in gas sales due to these many small appliances and the further increase that would come with a more general use of gas for heating purposes, they naturally pushed that side of their business which would give them the best load factor and which would come to them with the least effort. All season or general house heating does not give an ideal load factor, as it makes a heavy demand on both production and distribution, and produces revenue only during a part of the year. Even where gas rates are most favorable, the fuel cost is usually higher than coal, and a more or less expensive educational campaign is needed to induce people to see the benefits of the apparently more expensive fuel. Then, too, the gas appliances available have not been entirely satisfactory for general use.

Basic Idea of System a By-product of Incandescent Mantle Experiments

These reasons are sufficient to explain the tardy acceptance of gas for general heating of buildings, but in spite of them, due largely to the energy of a few manufacturers of heaters, it has extended at a gradually increasing rate and now is no longer uncommon in those localities, or for those buildings for which the appliances now on the market are suitable.

About 1909, Alcorn Rector, while experimenting with incandescent mantle gas lamps, particularly with the view of increasing the quantity or intensity of the light as well as the efficiency of the lamp, adopted the exhaust instead of the pressure method for augmenting the proportion of primary air in his atmospheric burners. Keen and observant, he immediately saw that the heat of the products of combustion in the exhaust pipe might be utilized in a radiator for room or space heating. Tests soon showed him that with properly designed radiation the system would show an efficiency unknown till then, and that beyond this gain some most desirable features of ventilation, valve operation and temperature control would be possible.

For several years Mr. Rector struggled with those obstacles usually met with by the inventor of moderate means, constantly improving his system by the slow and unsatisfactory means of fault elimination in commercial installations, until about two years ago he formed a connection with a well-known company with manufacturing and commercial facilities to properly build, sell and install the system. The faults of the heating units and their parts have been overcome and improvements made in them, units of several sizes have been designed, and specifications drawn up for the installation of the radiation, piping, exhaust fan, etc., for a system of heating primarily adapted for the heating of a building or one large section of a building, although it is perfectly practical to install a single radiator.

The Rector system is a distinct departure from any previous plan of heating. Its basic principle is the generation of heat at the exact point where heat is needed, and at the exact time when heat is wanted, with the added feature of positive ventilation. The ventilation, though positive, is not, however, to be considered as sufficient in quantity to meet the requirements of the usual building laws for auditoriums. It is sufficient, however, to make the atmosphere of the ordinary living room noticeably more satisfactory.

It is obvious that the cost of artificial gas demands that any apparatus devised to utilize it as a fuel should positively provide for: (1) perfect combustion, (2) complete utilization of its heat, and (3) proper ventilation. The accomplishment of these three ends is a primary requisite, and any apparatus which does not achieve these results will not be largely successful in broadening the use of gas as a heating agent. Further than this, any such apparatus should provide so easy a fuel supply control that the fuel may be shut off and its expense eliminated almost at the instant that a room or group of rooms becomes properly heated, or their occupancy has ceased.

Elementally, the G. F. E. Rector system is a hot-air system, heat being obtained by passing the hot products of combustion from the gas burner through the various sections of a metal radiator. The design of the burner box and the radiation are such that practically all of the heat from the products of combustion is radiated into the room before the products are exhausted from the radiator. Where thermostatic control is provided, the fuel supply is operated, not by chance, but by the temperature of the room itself.

Making All the Heat Evolved Do Useful Work

In most gas radiators, the products of combustion leave the radiator at a very high temperature, and, when

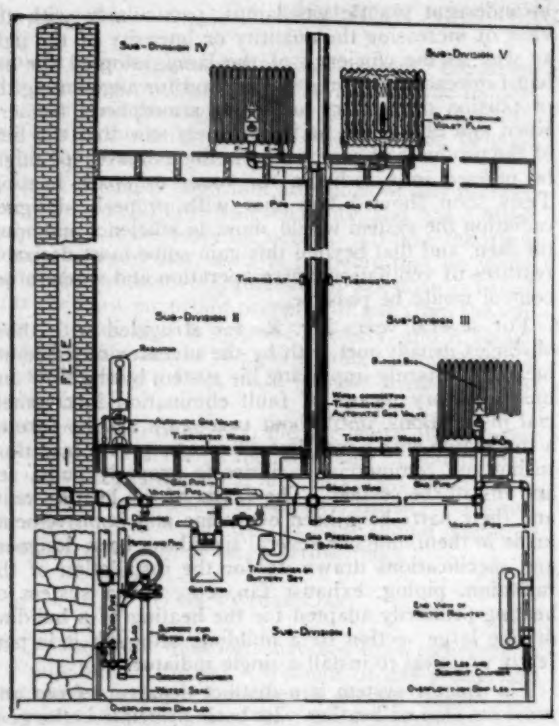


FIG. 1—DIAGRAMMATIC CHART OF SYSTEM

a flue is provided, pass through it to the outside air still containing a great deal of heat which should be given up in the room if fuel waste is to be eliminated. When the appliance is not provided with a flue, all of the heat from the gas is, of course, available for heating the room, but as this heat is largely heat of convection in the products of combustion its actual effect on the comfort of the occupants of the room is not as satisfactory as might be supposed.

Broadly, the Rector system as it is installed, is similar in arrangement to the two-pipe steam heating system, each room being equipped with the number of radiators necessary to suitably heat it. Each radiator has its own individual valve so that it is a complete heating unit. All of the radiators, however, are connected together into one vacuum system, and the products of combustion, after their heat has been radiated into the room, are drawn through this vacuum piping and expelled out of doors by the agency of a small motor-driven suction fan.

For the details of the G. F. E. Rector system, reference may be had to Fig. 1, which illustrates it diagrammatically. Sub-division I shows the details of the basement arrangement from which it will be readily seen that none of the apparatus takes up any large amount of space, thus leaving the cellar entirely free for other uses. The most important part of the basement equipment is the fan, which is interposed at any convenient point in the vacuum line of pipe, and unless other power is available this fan is driven by a small direct-connected electric motor. When the fan is running air is drawn through all radiators as each radiator is connected to the vacuum system by the tee between the bottom sections. It is through this system of vacuum pipe that all products of combustion are removed from the radiators and expelled out of doors through the flue as shown.

Necessity of Drip Legs

Several drip legs are necessary because one of the products of gas combustion is water vapor and these drip legs are provided to remove this water and other sediment from the vacuum piping, so that they will not accumulate and break the vacuum.

The gas piping which supplies the radiator starts from the house side of the gas meter, connections being made to each radiator at V' in the automatic radiator valve, Fig. 7. A shut-off is installed in each radiator connection so that the entire radiator may be removed from the system without affecting the balance of the heating plant. The gas pressure regulator shown may, where necessary, be installed in the gas pipe near the meter and it maintains a constant gas pressure at all times regardless of the pressure fluctuations in the city gas main.

Sub-divivsion II shows an end view of a radiator illustrating how the automatic gas valve is connected to the burner box of the radiator. Here will be noticed the thermostat wiring between the thermostat on the wall and the automatic gas valve of the radiator. This thermostat automatically controls the room temperature by means of a solenoid attached to the automatic radiator valve, the gas being turned *on* when the room temperature is lower than the temperature indicated on the thermostat dial and *off* when the room temperature is higher than the temperature indicated. The thermostat circuits are operated at a low voltage (10 to 14 volts).

Sub-division III shows a part section through the individual radiator. When the gas cock is opened, a very small part of the gas admitted feeds directly into the little pilot in the burner box. The pilot is lighted by opening the burner box door and inserting a match just as any ordinary gas burner would be lighted. The pilot light gives off a very small amount of heat and consumes a nominal amount of gas. Once it is lighted, therefore, it is usually left burning throughout the entire heating season. Its sole purpose is to ignite the gas in the main burner when it is admitted by the operation of the automatic gas valve.

In Sub-division V a cross-section of the radiator is diagrammatically shown illustrating the violet flame in the burner. The little arrows show how the products of combustion and all the heated gases are circulated through the radiator until practically all of their heat has been delivered into the room. After the gases have been cooled practically to room temperature, they are drawn into the exhaust as shown by the arrows, taken through the vacuum system and expelled out of doors through the flue.

Similar to Direct Hot-Water of Steam-Type Radiator

Fig. 2 shows the G. F. E. Rector radiator, which is similar to the common direct hot-water or steam-type radiator with the central sections removed and the gas combustion chamber A inserted in their place. This combustion chamber is connected to the top of the radiator sections only. The tee B of the same width as the combustion chamber is inserted in the bottom sections to couple them together and provide a connection to the vacuum system. Heat is generated by burning

gas in the combustion chamber of the radiator and by means of the suction fan, the hot products of combustion are drawn throughout all sections of the radiator, which is so proportioned that by the time they reach the exhaust pipe they have given up practically all of their heat.

Further details of the combustion chamber are shown in Fig. 3, which is a sectional view of the lower part of the burner box A, in the front of which is the door C for access to the burners, etc. This door is provided with a mica window D, so that the flame may be observed without opening the door.

In the back of the box is an air inlet E, provided with a flap. This flap is so constructed that it hangs open, except when the fan is running, and through it air is supplied to the pilot flame. When the fan is in operation the suction pulls the flap to its seat, thus preventing any admission of air except through the burners. A similar flap is placed at the top of the burner box to permit the escape of the products of combustion from the small pilot burner when the fan is not in operation.

Fig. 3 also shows the position of the main and pilot burners in the burner box or combustion chamber. Through an opening in the bottom of the burner box

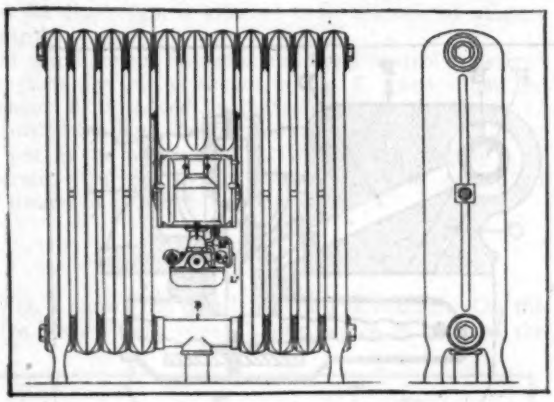


FIG. 2—A TYPICAL RADIATOR

the mixing tube C″ projects and is fastened in place by the valve flange nut D″. The lower end of the mixing tube is attached to the automatic valve body (at K Fig. 4) by stud bolts. The main burner E″ fits loosely on the upper end of the mixing tube and consists of a body of cast brass with alternate strips of plain and corrugated brass held in the body by brass end clamps. The burner orifices are formed by the spaces between the plain and corrugated strips which are so designed that they effectually prevent "flashing back" and at the same time readily permit cleaning, if necessary.

Pilot Burner the Product of Exhaustive Study

The pilot burner is the result of long and careful experiment under all conditions and consists of several parts so designed as to be simple and rugged. A nipple or tube of iron pipe G″ screws into the bottom of the burner box. On top of this tube is the pilot body H″, which serves as a shield for the pilot flame which burns from the end of the pilot tube J″. In the lower end of the nipple is a plug K″ with two holes, which serve as gas and air passages. The pilot tube enters the top of

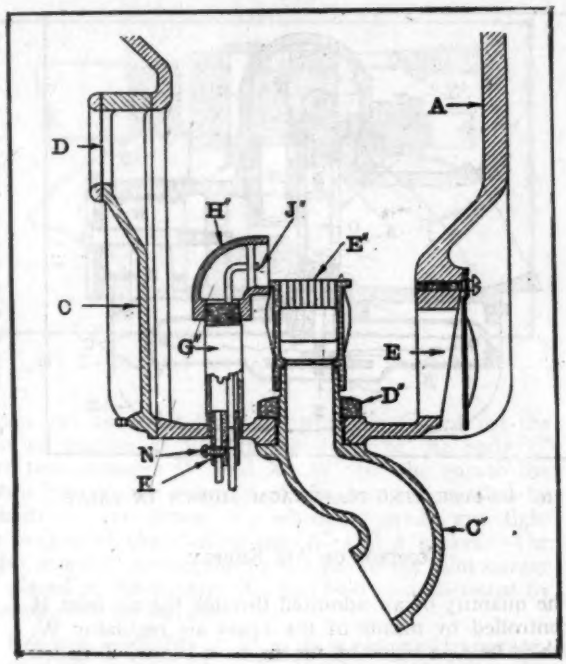


FIG. 3—LOWER PART OF BURNER BOX

the gas passage and the pilot connecting tube (shown at L″, Fig. 2) enters the bottom. The upper end of the air passage is open and the lower end receives the air connecting tube (M″, Fig. 2). In this passage is an air regulating screw N″. These connecting tubes are attached to the gas control body U′ and the interior of the automatic valve body F (Fig. 7) by slip joints at their lower ends. The gas for the pilot is regulated by the pilot screw Z′ (Fig. 7) and the air needed by the pilot for perfect combustion is regulated by the screw N″.

The present automatic gas valve of the G. F. E. Rector system is so radically different from any other valve previously used for this purpose that a somewhat detailed description of it is warranted. The functions of this valve have already been indicated and Fig. 4, 5, 6 and 7 show in section its operating mechanism.

The valve consists of the body F, Fig. 4, made from a special mixture of cast iron, which contains the gas inlet G, the air inlet H, and the gas and air mixing chamber J. The mixing chamber J is connected to the gas burner by means of stud bolts at the ground surface K. Axially supported in the body is the valve tube L. The valve proper consists of the bronze ball M, with its stem N, and weight O. The ball valve M seats on the upper end of the tube L, and normally is kept closed by the weight of M, N and O.

Also axially supported from the body is the corrugated bronze diaphragm P to which is soldered the diaphragm spud Q. On the lower part of the diaphragm is soldered the boss R, which is threaded to receive the diaphragm spindle S. This spindle also carries the diaphragm weight T. The diaphragm is enclosed in the diaphragm case U, which is made in two parts. The position of the diaphragm case in relation to the body is maintained by means of the diaphragm spud nut V.

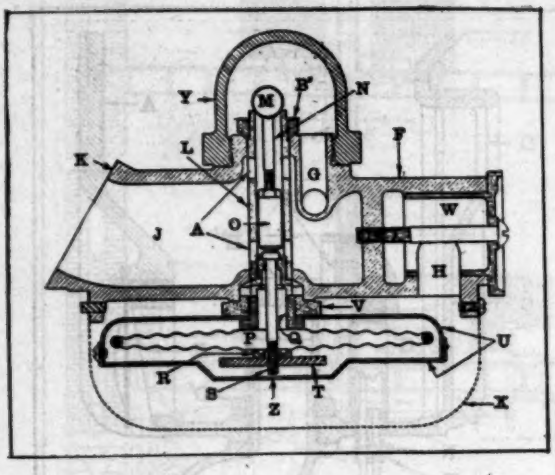


FIG. 4—OPERATING DIAPHRAGM SHOWN IN VALVE

Control of Air Supply

The quantity of air admitted through the air inlet H is controlled by means of the brass air regulator W, which is held in place by means of a screw, threaded into a bridge of the valve body. The air strainer X is a finely perforated brass screen, which is attached to the valve body by screws and which may be removed for cleaning or for inspection of the valve. On top of the valve body is the cast-iron valve cap Y, which makes a gas-tight chamber around the ball valve.

In Fig. 4, the parts are shown in the normal position, the gas valve being closed and the ball resting on its seat. As soon as the exhaust fan starts there is a vacuum or negative pressure created throughout the exhaust piping, the radiators and down through the burner into the mixing chamber J. This negative pressure extends down through the diaphragm spud nut Q and inside of the diaphragm P. As the outside of the diaphragm is subject to atmospheric pressure, which enters through the hole Z, in the bottom of the diaphragm case U, the lower part of the diaphragm moves upwards, raising the diaphragm spindle S so that it comes in contact with the valve weight O, lifting the ball valve M from its seat and allowing gas to pass from the gas inlet G down through the interior of the valve tube L and out through the holes A into the mixing chamber J. Simultaneously air is drawn in through the air inlet H and the interior of the valve body to the mixing chamber J. Here it mixes with the gas which has already entered and the mixture passes to the burner.

Stoppage of Exhaust Shuts Off Gas

If the exhaust ceases there is nothing to hold the lower part of the diaphragm in its raised position and the counteracting weight T causes the diaphragm to move back to its normal position, permitting the weight O to pull the diaphragm valve M securely against its seat, thus shutting off the gas.

Fig. 5 illustrates the control of several radiators on the same line when it is desirable to close one of them while the exhaust is still operating. In the valve body F there is a passage B', from which lead two other passages, the first, C', giving direct connection with the atmosphere at a point just above the diaphragm case U, but inside of the screen X.

The second passage, D', gives communication from the passage B' to the opening E' in the diaphragm spud Q. A plug valve F' is provided in the passage B', which normally closes communication between the passages C' and D'. When one radiator is not to be operated the plug valve is turned so that there will be communication through the passages C' and D' and the opening E' through the spud Q to the interior of the diaphragm P. Consequently atmospheric pressure is exerted both on the inside and the outside of the diaphragm. Therefore there will be no tendency for the lower part of the diaphragm to rise and the gas valve will remain closed. This plug valve may be controlled either by hand or by a thermostat, as later described.

The constant inflow of air through the valve when the blower is in operation might cause dust to collect in the valve passages and the purpose of the screen X (Fig. 4) is to prevent this, all of the air entering any part of the apparatus being drawn through this screen,

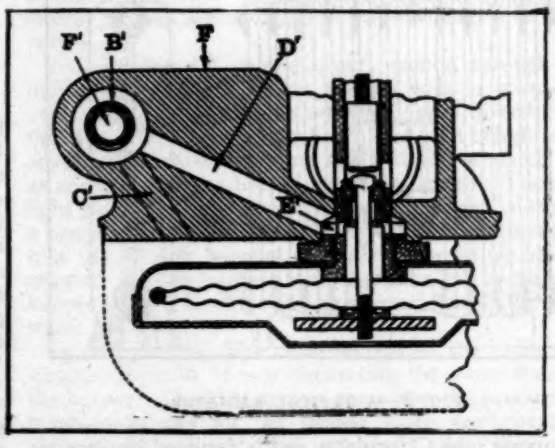


FIG. 5—CONTROL DETAIL OF VALVE FOR CLOSING OFF RADIATOR INDEPENDENTLY

which is easily cleaned without removal, although easy removal is provided for.

While a simple plug valve may be used at F', Fig. 5, experience has shown the desirability of a control which is more universal in character. This is illustrated in Fig. 6. The valve body G' has a base for holding a solenoid at the back and threaded in front for the cap nut H'. In the valve body are two annular channels, J' and K', communicating respectively with the passages C' and D', and the axial passage into which fits the sleeve L' a thin cylinder open at the back and carrying at the front the handle M' fastened to the sleeve by means of a screw. Communication between the channels J' and K' is obtained by the holes N', O' and P'—when the sleeve L' is turned to certain positions. R' is a cylindrical plunger actuated by the armature of the solenoid. A dial or indicator plate S' shows the various operating positions of the parts.

Hand Control

When magnet control is to be employed the handle M′ is turned to the position shown, bringing the hole N′ so that there is, at all times, communication between the atmosphere through the passage C′ and the interior of the sleeve. With the plunger R′ in the position shown the passage P′ is closed so that the diaphragm is only subject to the pressure caused by the fan. If the armature of the solenoid is moved to the left (in the illustration) it will pull the plunger to the left, uncovering the hole P′, permitting atmospheric pressure to pass from the interior of the screen X through C′, N′, P′ and D′ to the interior of the diaphragm so that the latter is not affected by the suction of the fan. The magnet, therefore, does not directly operate the valve, but simply controls the air passages, breaking the vacuum, thus allowing the valve to close.

When hand control is desired the solenoid is dispensed with the hole in the back of the body being plugged. Control of the vacuum is then obtained by revolving the sleeve L′ by means of the handle M′ to a position as indicated on the dial plate. By this means communication between the holes N′ and O′ is opened or closed and the diaphragm is affected as in the case of magnet control.

If simultaneous magnetic and hand control is desired the parts are left as shown in Fig. 6, when either the plunger R′ is moved by the solenoid or the sleeve L′ is turned by hand, but in this case the handle M′ must be put in the position M A G when the magnet is to operate. Current to the solenoid may be controlled by means of a switch or thermostat.

Accessibility of Parts

Fig. 7 shows the details of the gas control. On the valve body F is a boss T′, into which is screwed the brass gas and pilot body U′, which is tapped for the gas connection at V′. In the front of the body U′ are two passages W′ and X′, W′ for the gas to the main burner, the quantity of gas being controlled by means of the screw Y′, which is made gas tight by means of the stuffing nut A″ and a gasket. The pilot screw Z′ for regulating the gas to the pilot burner is placed in the passage X′, and held in adjustment by means of a spring.

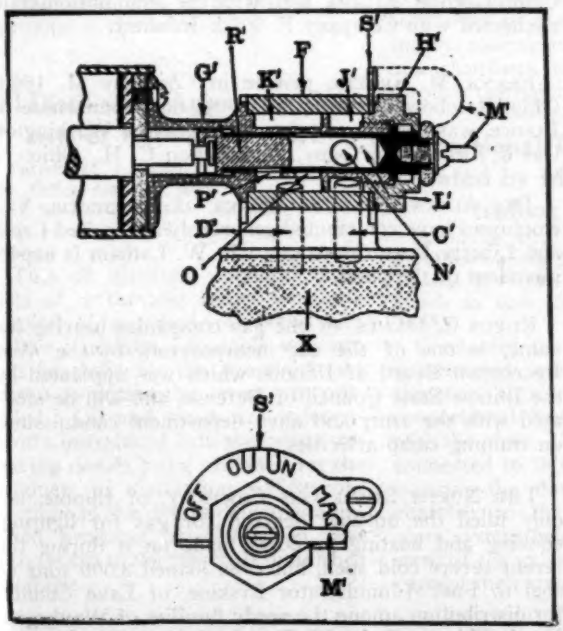


FIG. 6—MECHANISM FOR ALTERING FROM HAND TO MAGNETIC CONTROL

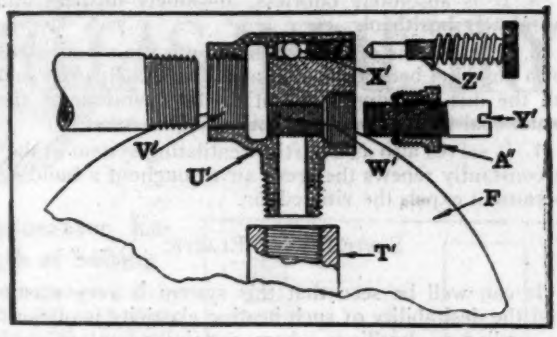


FIG. 7—DETAILS OF GAS CONTROL MECHANISM

Ready accessibility to all parts is obtained by removing the air screen X, the valve body cap Y and the valve tube nut B″, Fig. 4. When these are removed all of the working parts of the valve, with the diaphragm, may be removed as a unit. The diaphragm may be examined or adjusted by opening the diaphragm case by removing the screws which hold the two parts together.

As the temperature of the burner box is somewhat higher than in the common steam or hot-water radiator, it is at times desirable to provide a guard to prevent contact with the hot parts of the radiator. There are many satisfactory kinds of such guards, but one has been adopted as a standard with which all radiators are equipped, unless some other is specified. This guard is of heavy sheet steel, perforated in a diamond pattern, and consists of two parts, the guard, or top, curved to conform to the top of the radiator, and the apron, which is supported by the guard, protects not only the burner box, but the valve and other working parts.

The guard is rigidly attached to the radiator by brackets, which screw into the tapped holes in the tops of the sections and the apron is so attached to the guard that it may be easily swung aside to give access to the burner box or valve. The guard also carries a protecting shield above and behind the radiator, the shield being designed to increase materially the circulation of air over the hottest part of the radiator.

From this description it will be evident that there are several distinct and desirable heating conveniences with the G. F. E. Rector gas heating system:

1. It gives exactly the amount of heat just when and where wanted.
2. It gives nearly 100 per cent heating value from the fuel used.
3. When equipped with thermostatic control it gives an even, non-fluctuating temperature, no matter how sharp and sudden the outside temperature changes.
4. It requires the minimum of attention and, aside from minor adjustments in its mechanism, can be run as readily by a woman as by a man.

5. It is absolutely odorless, absolutely dustless and absolutely healthful.

6. It leaves the cellar just as clean as the other rooms of a building, because it does away with coal, ashes and all the dirt and dust incident to the operation of the usual coal-fired furnace or boiler.

7. It serves also as a partial ventilating system in that it constantly renews the fresh air throughout a building because it expels the vitiated air.

System Very Elastic .

It can well be seen that this system is very elastic and the desirability of such heating elasticity is obvious as applied to dwellings where certain rooms are used infrequently, but where heat must be quickly obtainable when needed. The advantage of such elasticity in heating as applied to business buildings is not so readily evident, but in such cases the janitor or engineer is enabled to give an adjustment of different temperatures in various sections of the building.

From the foregoing description it is clear that the G. F. E. Rector system differs fundamentally from practically all other gas appliances, in that it is pre-eminently a *system* of heating, whereas other appliances are only heating units, except, of course, where gas is used for fuel in a central heating plant. There is a great field, and will always be a great field, for heating appliances of the unit type, but the system just described is certainly unique in that it is practically the only type of gas heating appliance which has been consistently and scientifically developed, not as a heating unit, but as a complete heating system.

How the Gas Companies Are Helping the Nation

The Consolidated Gas Company, of New York, has the following employees on its Honor Roll, including those names previously published:

J. Rutz.....National Army
E. P. Scanlon.....Infantry
F. P. Schadek.....13th Coast Defense
Frank Schafer.....69th Infantry
Fred Schmidt.....22nd Engineers

Carlton Schroeder.....71st Infantry
John Scully.....National Army
J. Seebach.....12th Infantry, N. Y.
A. Seel.....Canadian Exped. Force
N. T. Sellman.....8th Coast Artillery, N. Y.

Thomas Senior.....104th Coast Artillery
Warren Shampnoi.....10th Infantry
Charles Shattenkick.....69th Infantry
C. A. Shear.....69th Infantry, N. Y.
Thomas S. Shields.....Navy

C. C. Simpson.....Officers' Reserve
John H. Simons.....10th Infantry
J. Slays.....8th Coast Defense
Robert Slater.....Naval Reserve
L. E. Sloatman.....1st Field Artillery

The Peoples Gas Light Company, serving Manchester, N. H., has the following employees among those on its Honor Roll:

Charles Gleavin.....Co. B, 1st N. H. Infantry
Jeremiah Morley.....Co. K, 1st N. H. Infantry
Michael F. O'Connor.....Co. K, 1st N. H. Infantry
A. H. Scott.....R. O. T. C., Plattsburg

H. F. Dodd, formerly connected with the Nashville Gas & Heating Company, of Nashville, Tenn., is now with Bat. Non. Com. Staff, 1st Tennessee Infantry.

The Wyandotte County Gas Company, of Kansas City, Kan., has the following employees in the military and naval service:

Estill M. Anderson.....U. S. Navy
Alexander Catton.....U. S. Navy
Robert A. Hatfield.....Mach. Gun Co., 140th Infantry, Camp Doniphan, Fort Sill, Okla.
Fred. Sofge....Co. J, 4th Reg., Camp Paul Jones, Gr. Lakes, Ill.

Robert H. Rockhold, who was formerly in the employ of the Burlington Gas Light Company, of Burlington, Iowa, is now at Camp Dodge, Iowa.

Horace Oves is now with Troop C, Pennsylvania Cavalry. He was formerly in the employ of the Harrisburg Gas Company, Harrisburg, Pa.

B. V. Pfeiffer, formerly an employee of the Nashville Gas & Heating Company, of Nashville, Tenn., is now at Camp Gordon, Ga.

Edward F. Sweeney, who was formerly a truck driver in the employ of the New Bedford Gas & Edison Light Company, of New Bedford, Mass., is now at Camp Gordon, Atlanta, Ga., with the ammunition train connected with Company F, 307th Infantry.

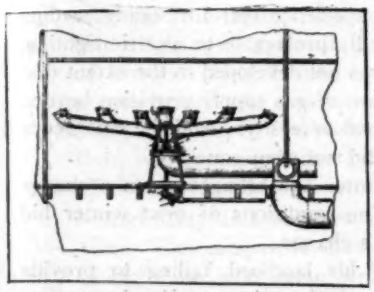
Frank M. Skyles, private in Company M, 166th Ohio, Rainbow Division, A. E. F., now somewhere in France, was formerly in the employ of the Washington Gas & Electric Company, Washington C. H., Ohio.

The Alexandria Gas Works, of Alexandria, Va., employees have contributed generously to the Red Cross and Liberty Loan campaigns. F. W. Latham is superintendent of the plant.

Rufus C. Dawes, of the gas companies bearing his name, is one of the six incorporators of the War Recreation Board of Illinois, which was appointed by the Illinois State Council of Defense, and will be affiliated with the army and navy department commissions on training camp activities.

The North Shore Gas Company, of Illinois, not only filled the unusual demand for gas for lighting, cooking and heating purposes made on it during the recent severe cold spell, but even loaned 3,000 tons of coal to Fuel Administrator Erskine, of Lake County, for distribution among the needy families of Waukegan, North Chicago, Lake Bluff and Highland Park.

PATENTS PERTINENT TO GAS INDUSTRY



Drying Apparatus Consists of Rotary Gas Burner

Patent No. 1,223,560; described in Patent Office *Gazette*, May 1, 1917, page 160. Frank Emerson Needham and Berton Washington Emerick, Salem, Ore. Filed May 15, 1916. Serial No. 97,679. (Cl. 34-19)

This device consists of a head with an open bottom and a number of hollow radiating arms extending from the head. Each of the arms is provided with outlets. A stand is equipped with a circular track, the head being mounted on the track, and external means are provided for revolving the head on the track. Gas is supplied through the open bottom of the head, and is burned at the openings in the arms.

Oil Distillation Apparatus Consists of Rotating Retort

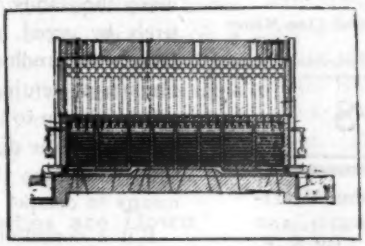
Patent No. 1,227,558; described in Patent Office *Gazette*, May 22, 1917. page 1303. Samuel N. Herber, Inza, Mo. Filed Aug. 7, 1915. Serial No. 44,299. (Cl. 196-20.)

This oil distilling appliance consists of a rotating retort which is formed of a cylindrical body with hollow trunnions. Suitable supports and bearings for the trunnions and means to rotate the retort are provided. Oil and steam are independently introduced into the retort, receiving domes being provided for the products of distillation. Pipe connections to the domes deliver the finished products of distillation, and also return to the retort all unfinished products.

Coke Oven Regenerator Extends Full Length of Setting

Patent No. 1,227,518; described in Patent Office *Gazette*, May 22, 1917, page 1291. Elmer J. Crossen, Joilet, Ill. Filed Sept. 25, 1915. Serial No. 52,591. (Cl. 202-9.)

This coke oven structure consists of a coke oven, with a regenerator of the same length located directly beneath the oven. A row of combustion chambers is vertically arranged along the two longitudinal side walls of the ovens. Ports extend laterally in both directions from the upper part of the regenerator into the lower

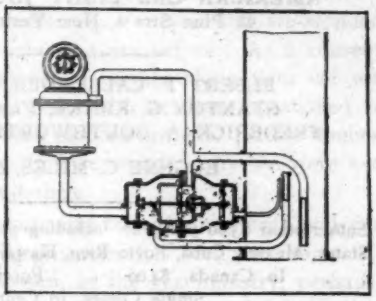


ends of the combustion chambers. Gaseous fuel is periodically supplied to all of the combustion chambers at both sides of the oven, and the air supply, passing to all of the combustion chambers, is controlled to and through the regenerator.

Proportional Gas Meter Operated by Means of Controlling Machine

Patent No. 1,226,158; described in Patent Office *Gazette*, May 15, 1917, page 797. Thomas B. Wylie, Pittsburgh, Pa. Filed March 29, 1916. Serial No. 87,611. (Cl. 73-68.)

Connected to the pipe containing unmeasured gas is a controlling chamber, with a constant full open proportional flow passage connected with the pipe. The tally meter is also connected to this chamber. A valve controls the flow of gas from the chamber to the meter, a pressure plate system being connected to the stem of the valve and operating it, to control the extent of the valve opening in accordance with the changes of flow in the pipe. Another pipe leads from the tally meter, which is connected to the chamber behind one of the diaphragms, and is also connected to the pipe containing the unmeasured gas.



Material for the Production of Self Lighting Gas Mantles

Patent No. 1,227,259; described in Patent Office *Gazette*, May 22, 1917, page 1207. John G. Gotty, Jacksonville, Fla., assignor to Gotty Gas Lighting Company, a Corporation of Florida. Filed Aug. 29, 1916. Serial No. 117,480. (Cl. 67-99.)

This material consists of platinum black, particles of metallic platinum, and a dissolvent which consists of alcohol, glycerine and dextrose.

Gas Burner is Equipped with Movable Annular Ring

Patent No. 1,227,189; described in Patent Office *Gazette*, May 22, 1917, page 1183. Lewis F. Ostrander, St. Louis, Mo., assignor of one-half to J. F. Esperon, Indianapolis, Ind. Filed July 13, 1916. Serial No. 109,115. (Cl. 258-106.)

This gas burner consists of a hollow burner ring provided with jet openings. A gas pipe leads to the hollow member. A movable annular hood is placed over the hollow ring, the body of the hood being of a shape in cross-section similar to an inverted U. The walls of the hood are spaced from the ring, openings being placed in the outer wall of the hood directly opposite the jet openings.

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CONTENTS

SILK RIBBON SUBSTITUTE AND BRAID FOR MILLINERY TRADE MADE FROM MILKWEED AND WOOD PULP WITH THE AID OF GAS. BY S. E. WARDELL 121

GAS VS. ITS VARIOUS COMPETITORS IN THE FUTURE 123

OPERATING THE RECTOR GAS HEATING SYSTEM 124

HOW THE GAS COMPANIES ARE HELPING THE NATION 130

PATENTS PERTINENT TO THE GAS INDUSTRY 131

EDITORIALS 132

GAS VS. ELECTRIC LIGHTING IN REGARD TO THE SOLUTION OF WARTIME PROBLEMS 134

MERCHANDISING GAS 135

DISCUSSION AT NEW ENGLAND GAS SALES ASSOCIATION MEETING TENDS TO SHOW THAT USE OF PREPAYMENT METER DOES NOT EFFECT INDIVIDUAL CONSUMER'S USE OF GAS 135

PROVING TO CHAIN STORE MANAGEMENT THE VAST SUPERIORITY OF GAS OVER ELECTRICITY AS THE MODERN STORE ILLUMINANT BRINGS ABOUT RE-EQUIPMENT OF 22-STORE SYSTEM 137

NEWS OF THE GAS INDUSTRY 139

PERSONAL NOTES 143

CONSTRUCTION NOTES WILL BE FOUND ON PAGE 16 OF THE ADVERTISING SECTION

Provisions for Heating by Gas a Necessity in New Buildings

There had developed a tendency on the part of builders in large cities to view as non-essential provision for gas supply in dwellings for any purpose beyond that of cooking. Such a viewpoint seemed incomprehensible to the gas man, but it must be conceded it apparently did not detract from the rentability of the dwellings.

The prospective tenant might have liked possibly one or two gas lamps in his apartments, might, indeed, have discovered through experience that for steady reading gas lighting is markedly preferable to electric lighting, but this preference was not developed to the extent that he viewed the inclusion of gas supply provision beyond the kitchen as an actual necessity. And the emergency heating question he did not even consider.

But the present winter has brought about a change in his viewpoint. The conditions of next winter bid fair to emphasize this change.

The possibility of his landlord failing to provide him with adequate heat had not occurred to the average tenant before.

It is true that such a condition had occurred in isolated cases, which in the aggregate doubtless would be many thousands, but the failure had been prompted entirely by greed, and the courts gave scant consideration to the landlord's side in such cases. Consequently, the tenant renting a house assumed that the landlord would live up to the conditions of the lease in regard to heating. If he did not happen to be an honest landlord the tenant knew that in the courts he could find a ready means to compel him to do so.

But a condition where, regardless of the landlord's intention or morality, the tenant is liable to be shut off from the central heating source, is a new condition that the present winter has introduced. It has made an impression. Thousands have suffered intensely. Many have seen their children and the aged fall ill due to the arduous conditions they have had to live under, and doubtless many have had tragedies in the family. This because of a lack of auxiliary heating facilities.

The rentability of dwellings wherein there is no provision for gas heating is certain to be influenced by the experiences the country's city dwellers have been through this winter, regardless of whether the gas companies drive the lessons home through publicity or not. But it is certain that the majority of gas companies will adopt this latter course, and they will not lack effective ammunition in their endeavor. It is not only good business, but their duty as well.

The following news item indicates clearly what is to be expected in the coming winter:

"The Fuel Administrator in his warning says that the fuel shortage is expected to be more acute next winter than it is now."

For the time being, then, the respective costs of gas and coal for heating are immaterial. It is a question of freedom from hardship, health and in many cases even life. No sane man will condemn his family to the possible ardors of a dwelling wherein, if there is no coal in the cellar, its members must grin and bear the cold without relief, when there is a gas-piped dwelling available.

For the future there exists the possibility that the cost of gas heating and raw fuel heating will not be far apart, with the numerous advantages of gas to influence selection in its favor. Coal at the prices it was obtainable a few years ago will, it is likely, become a matter of history. New houses to-day will possibly be old houses before coal goes down to levels that will give it a material primary fuel cost advantage. And gas, meantime, will become cheaper, in effect, through increased efficiency in appliances.

Architects and builders should take note of these facts. Gas companies should assume the task of educating those who make their operations possible—the individuals and corporations that lend them the money —in regard to them.

The value of an investment is determined more by its possible earning power than by the money that has been put into it. A practical $50,000 apartment house in a growing city represents a better security on a $40,000 loan than would a $1,000,000 hotel in the Sahara Desert. The completely gas-piped dwelling by the same reasoning will prove a more easily rented dwelling than one in which there is piping only to the kitchen.

Why Prices for Securities are Down

A correspondent asks us why securities of such unquestionable merit as gas company stocks are selling at such low prices.

The obvious answer would seem that the costs of gas manufacture and supply go up almost overnight, while it sometimes requires months to obtain a corresponding increase in rates. But this would not be a complete answer, since the general run of securities in all lines are selling at what would normally be unusually attractive prices.

The reason lies in the purchasing power of the dollar. Assuming that this has been cut in half, the investment that brings 7 per cent now brings in practical effect but 3½ per cent. In other words, if it was costing us a thousand dollars to live before, it now costs us two thousand dollars to live in the same manner. If we are dependent upon the return from our investments, and we just had enough, we must, if we do not wish to curtail, find some place for our money where we can get 14 per cent from it. Hence the decline in selling prices of securities. It isn't what the dollar is that counts. It is what it will buy.

Consumer Preference for the Prepayment Meter

Periodically the respective advantages or disadvantages of the prepayment meter come up for discussion in the gas industry. We are now apparently on the threshold of one of these periods. While we are in the thrall of some speakers, it is difficult sometimes to believe that the type has any advantages; that it is not, in fact, a distinct menace to the welfare of the industry. Then others will arise and brush the disadvantages aside as if they were nothing, and point out advantages that seem so pronounced that we wonder why we never thought of them before. As a consequence we find ourselves no farther along than we were at the beginning; only with restless, unsatisfied minds. Doubts have been planted in them. These doubts have been dispelled, but we wonder why we were even inclined to credit them.

Discussion pro and con of the merits and demerits of the prepayment meter has been the source of more fruitless discussion in the gas industry, perhaps, than any other feature of gas supply equipment. Why?

We have confined ourselves mainly to what might be termed the mechanical features of the problem. We have not come into the discussion conversant with all the features that have a bearing on it.

For one thing we must concede that the prepayment meter has stood the test of time. It is not a get-rich-quick scheme that can hold us entranced for the moment, only to be consigned to oblivion a short time afterwards when we have unmasked it as a sham.

It has not been the expenditure of hundreds of thousands of dollars in advertising that made possible Omega Oil, Quaker Oats, the International Correspondence School courses, etc. There was merit behind these products, else the hundreds of thousands of dollars spent in advertising them would have been thrown away. Unless a product has a reason for existence it cannot exist, except for a very transient period.

So many of us are so accustomed to receiving our wage by check, and handling a very small proportion of it in cash that we forget that there is a considerable proportion of the citizenship of this country which receives its pay in cash in envelopes, that has no bank account, except a relatively inaccessible one, and that usually sets aside in advance a sufficient part of this pay in cash in some drawer, jar or perhaps under the mattress of a bed, to carry it through until the next pay day. This class does not have to run out to the corner store to get a bill changed to quarters in the emergency, and it prefers to pay in cash out of hand for the goods as it receives them. It is more convenient to this class to pay a quarter at one time than it is a dollar. It is also more convenient to pay it four times in the home than it is one time at the gas company's

office, or to make arrangements to have someone at home with it when the collector happens to call.

This brings us down to the most important consideration, one that we can never surmount, however much we may discuss it—that is, consumer preference. Experience has shown that a very good part of the population in some sections prefers the prepayment type; some to the extent that even the requirement of a substantial deposit does not deter them. And it is the consumer, in the last analysis, who determines the policy of the gas company.

The prepayment meter, like every other factor in gas manufacture and supply or any other human endeavor, presents various points of attack. It all depends upon the viewpoint. But to essay to say that it has no important place in the gas industry is to give voice to a colossal stupidity. It occupies a very important place to-day, and doubtless will in the future. What its place in the individual territory is, is for the management of that territory to decide.

Correspondence

Gas vs. Electric Lighting in Regard to the Solution of Wartime Problems

Editor's Note: The *Electrical World* in its Jan. 12 issue deplores editorially the tendency to regard electric lighting as applied to general use as a non-essential. It bases its stand on the statement that "a first-class central station turns out the kilowatt-hour on two to three pounds of coal, . . . and this amount of energy will supply a dozen 20-candle-power incandescent lamps for considerably more than the average evening's use."

It states further that: "If electric light were replaced by *gas* or oil, the *situation would not be bettered in the least*, for both require the use of amounts of fuel not to be neglected and more important than the fuel used in the electric light station."

The question raised by this latter statement is purely academic. No sincere gas lighting advocate desires to profit necessarily by considerations brought in by wartime conditions to displace electric lighting by gas. Those who have scored such achievements in the past have been able to do so only because they had faith in their product and sincerely believed it the best agency for the purpose for which they were selling it. And that is the only basis on which anyone who has the best interests of the gas industry at heart sells gas lighting to-day. All talk of rendering an appreciable and immediate national service by generally replacing electric lighting by gas lighting is buncombe, even if there were a certain saving in coal per candle-power-hour. Had the replacement been effected some years ago the situation of the nation at the present moment might be better than it now is, but making it now would involve the expenditure of energies that would, perhaps, nullify or even overbalance the saving effected. The question raised by the *Electrical World*, however, has an interest. The AMERICAN GAS ENGINEERING JOURNAL therefore requested Robert ff. Pierce to comment on it. His reply follows:

SIR: With reference to the editorial of the *Electrical World* under date of Jan. 12, concerning which you have asked my opinion, I would say that as far as the conservation of fuel is concerned I believe it is substantially correct. There are, undoubtedly, a great many central stations in which the amounts of fuel necessary to generate a kilowatt-hour exceed the 2 or 3 lb. of coal mentioned in the editorial, and these are, perhaps, of greater importance than would usually be expected on account of the large proportion of electric central stations which serve small communities, and therefore have not sufficient output to obtain the economies enjoyed by larger central stations. A comparison between gas and electricity on the basis of coal consumption would necessarily be restricted to coal and coke oven gas, as a direct fuel value comparison between oil and coal would not embrace the most important economic elements.

At 3 lb. of coal per kilowatt-hour 1 lb. of coal would produce 333 watt-hours, which consumed in lamps of the usual type might be expected to yield on an average, say, 333 candle-power-hours. Assuming that 1 lb. of coal will yield 5 cu. ft. of gas and two-thirds of a pound of coke, which may be taken as roughly equivalent to a similar amount of coal for fuel purposes, one-third of a pound of coal, would yield 5 cu. ft. of gas, or at the rate of 15 cu. ft. per pound, which at 20 candle-power per cubic foot would correspond to 300 candle-power-hours. The candle-powers referred to above are horizontal candle-powers, the ratio of horizontal to spherical candle-power being substantially the same with gas and electric lamps.

The fuels used in gas manufacture are rather highly specialized in their application and cannot be compared pound for pound with the fuels used in electric central stations. I do not believe it could be shown that any marked economic advantage on a strictly B.t.u. basis would follow the substitution of gas for electricity for lighting purposes.

You will, of course, note that the foregoing refers only to the question of coal conservation. There is, of course, a very important advantage to the public to be expected from the wider use of gas for lighting, and that is the saving in money. This results from the fact that whereas in the sale of gas in normal times only about three-fourths of the price received is absorbed by expenses other than for raw material, in the case of electric central stations about 95 per cent of the price obtained for residence lighting current represents expenses other than for coal under the boilers. Thus, in spite of the substantial equality in the matter of coal consumed per candle-power-hour, the use of gas light possesses distinct economic advantages, and the increased use of gas for illuminating purposes will render available for the prosecution of the war an increased amount of money which is in the last analysis the most important factor.

ROBERT FF. PIERCE,
Manager Illuminating Engineering Laboratories,
Welsbach Company, Gloucester, N. J.

1917 Sales of Water Heaters More Than in 1916

The number of hot water heaters sold last year, as reported in the *Public Service Lumen*, published by the Public Service Company of Northern Illinois, exceeded the figures of 1916. The increase made by salesmen amounted to nearly 18 per cent. The largest increase was in the automatic type of which, the record of 1916 being passed by nearly 80 per cent. In Division "D" over twice as many automatics were sold. Division "D" also led in the number of tank heaters installed.

C. E-Z. Campaigns Going On As Usual

Contrary to the general impression that gas companies have curtailed the activities of their new business departments, we find upon inquiry that this is only true of a few companies—mostly those having manufacturing difficulties.

The Welsbach Company reports its C.E-Z. campaign crews are busier than ever. Seven crews, consisting of a manager and ten men, are operating daily in various parts of the country.

In December campaigns were completed in the following cities: Empire Gas & Electric Company (seven plants located in New York State, namely: Auburn, Geneva, etc.), and also Des Moines, Iowa; Lafayette, Ind.; South Bend, Ind; Manchester, N. H.; Harrisburg, Pa.; Malden, Mass.; Lock Port, N. Y.; Syracuse, N. Y., and Rochester, N. Y.

In operation during January and February the following is a partial list of cities: All plants of the American Gas Company (about sixteen in all), and Fort Wayne, Ind.; Nashville, Tenn.; Bangor, Me.; Kingston, N. Y.; Phoenixville, Pa.; Pottstown, Pa., and Chester, Pa., including many of the surrounding Philadelphia towns; also Central Union Gas Company, New York City.

C.E-Z. campaigns get gas-lighting business into the foreground without a vast increase of gas consumption, and therefore meets many, if not all, requirements of the Government Fuel Administration.

Discussion At New England Gas Sales Association Meeting Tends to Show that Use of Prepayment Meter Does Not Effect Individual Consumer's Use of Gas

H. C. Crafts Shows by Actual Figures that Use of This Type Has Proved Advantageous to Pittsfield, Mass., Company—Psychology of the Payment in Advance for Small Quantities—Effect on Conservation

Even the scourge of the seven-year locusts does not recur with more consistent regularity than do the variations in attitude of the gas industry towards the prepayment meter. A season of years passes with this type being installed in increasing numbers. Then up springs a gas man who believes he has discovered they are a losing proposition. He is so convinced in his own mind that he is right that he is amazed to find others who do not agree with him. There arises once more the controversy—Do they or not promote a wider use of gas?

Merits and demerits are bandied back and forth. First one side carries conviction, then the other. Some tear out their prepays. Others install a greater proportion. The discussion subsides and the type persists. In fact, it prospers. What is the solution? One speaker asserts that the very fact that the type does persist is proof of its merit. There is a meed of common sense in this assertion. Advertising specialists will agree that unless a product has merit the bigger the sums invested in advertising the bigger the loss. That no unmeritorious product can exist is almost an axiom of commerce.

The American Gas Engineering Journal *does not intend to solve the prepayment meter question. It would if it could, but the subject has floored more than one authority. It contributes, however, this very frank discussion of the merits and demerits of the type, which took place at the meeting of an association whose membership includes gas men who should be more conversant with its advantages and disadvantages than the gas men of any other section of the country.*

The regular meeting of the Gas Sales Association of New England was held at the Boston City Club, Friday evening, Jan. 11, 1918. There were forty-four present, including guests from the N. C. G. A., N. E. Section, invited by Governor Gould.

After the usual dinner, Mr. Gould

introduced H. C. Crafts, of Pittsfield, Mass., the speaker of the evening.

Mr. Crafts read the following very interesting paper on prepayment gas meters:

We have all been through the same general experience with the prepayment meter. Designed originally as a means of doing business with people who would not, or could not, pay their gas bills, the prepayment meter has far outgrown its original limitations, until to-day something like 40 per cent of the newly installed meters in New England are of this type.

We have all, at times, been pleased at the thought that our money was coming in easily; that with increasing business our losses from uncollected amounts were not increasing at a proportionate rate. But then, again, when we have considered the additional capital required for this more expensive type of meter; when we have been having report after report of broken cash boxes and robberies with incidental annoyance of trying to collect the money a second time from the consumer; when we have found slugs and bad coins in the meters or have discovered employees who thought it safe to appropriate a portion of the contents, we have wished that the man had never been born who invented the device, and that every meter of its kind could be eliminated.

But it matters not whether we like it or not—the prepayment meter has become a permanent part of the life of the twentieth century. We wonder *why* any customer should prefer it, and we have spent many an hour, especially during the earlier stages of its development in trying to convince the consumer that the regular meter would save him time and bother, but the arguments usually availed little and the prepayment meters continued to be installed in increasing numbers.

Cannot Get Away from Fact of Consumer Preference

We cannot disguise the fact that the average gas consumer prefers them, that he find it easier to pay his bill in small amounts, and believes that he is getting more gas for the same amount of money.

In preparing this paper, I have not attempted to cover the methods in use among other companies for handling their meter department. I am giving the methods and results at Pittsfield only, and simply as a basis for discussion, without making any claims for their originality or results.

Location of Meters

Our prepayment meters, with but few exceptions, are installed so that they are not accessible to anyone but the consumer himself, being placed either in his individual cellar or in the apartment itself. We do not place meters in hotels, theaters or boarding houses; neither do we locate them in hallways or toilet rooms which are accessible to the general public. If a consumer desires a prepayment meter, and we find that the meter connections are not arranged so that they will comply with the above regulations, we insist upon the installation of a regular meter with the usual deposit, or a change in piping to and from the meter so that the consumer will have sole access to it. This change in piping is made at the expense of the consumer or landlord, and must be paid for before the work is done.

Indexing

On account of the relatively small number of regular meters which we have in use, we do not have continuous reading of regular meters, but read these in the old-fashioned way by putting on a force of men to complete them in two or three days at the last of the month.

We read our prepayment meters upon a practically continuous basis, beginning the route on about the seventeenth of the month and completing it on the thirteenth of the following month, and as the number of meters increases, we shall begin reading somewhat earlier and complete the reading correspondingly later. At the present time, during this interim of four days, we use the meter readers for special inspection or investigation of meters and accounts, which, for one reason or another, have attracted the special attention of our bookkeeping department during the month.

At the present time, it is costing us 20.7 cents per meter per year to read regular meters and 27.6 cents per meter to read prepayment meters.

Accounting

All of the money is removed from the meter and the index and amount of cash lifted is posted direct to the consumer's ledger account. The amount of gas actually consumed and its cash equivalent is entered upon the ledger, and the debit or credit balance for each account carried forward every month. A prompt investigation is made of debit balances, as it is impossible for these to exist unless there is something wrong.

Losses

The losses which are possible with the use of the prepayment meter are of four kinds:

1. From robbery.
2. From damage to meter, caused by breakage.
3. From bad coins or slugs.
4. From dishonest employees.

The most frequent loss which a gas company sustains in the use of prepayment meters is from the willful breaking open of the cash box, with the consequent loss of money and damage to the meter.

Our contract for the installation of the meter places the responsibility upon the consumer, and in case of breakage we require the immediate payment of a sufficient amount of money to balance this ledger account and the estimated cost of repairing the meter.

The collection of this money is one of the most disagreeable features in the use of the prepayment meter. We are immediately confronted with the statement that having paid for the gas once, they should not be compelled to pay their bill again, and this notwithstanding the fact that they have signed a definite contract to be responsible and have had the matter emphasized when the contract was signed. Our reply to this statement is, "That we provide and prefer to install the regular type of meter; that the prepayment meter is installed only as a convenience to the consumers, and upon their definite agreement to reimburse us for any loss in money or damage to meter."

We have had several cases where the consumers persisted in their refusal to pay, and referred the matter to their attorneys, but the signed contract and the above statement have always satisfied them.

Losses Insignificant

Our total net losses from prepayment meters for a period of five years, from July 1, 1912, to June 30, 1917, for money which could not be collected after breakage were

(*Continued on page* 140)

FIG. 1—"BEFORE"—THIS PHOTOGRAPH, TAKEN BEFORE GAS INSTALLATION WAS MADE, CLEARLY SHOWS THE HARSH CONTRAST OF LIGHT AND DARK AND THE GLARING EFFECT OF THE ELECTRIC LIGHT INSTALLATION

FIG. 2—"AFTER"—THIS PHOTOGRAPH, TAKEN AFTER GAS LAMPS HAD BEEN INSTALLED, SHOWS THE SOFTENING EFFECT OF GAS ILLUMINATION, CLEARLY BRINGS OUT THE GOODS ON DISPLAY AND GIVES SALESROOM A TOTALLY DIFFERENT ASPECT AND INVITING APPEARANCE

Boston Company Helps Educate People to the Use of Gas by that Strong Appeal—CONSERVATION

The Boston Consolidated Gas Company has inserted the following announcement in the daily newspapers relative to the economy of the use of gas in the present state of the coal supply. The arguments are conclusive as to the benefits to be derived by the user, and by the community at large, from the use of gas rather than coal in domestic heating and cooking:

"We should like to have our customers realize that by using gas they contribute to conservation of fuel.

"Where gas is used for cooking and manufacturing purposes, it takes about a third as much coal converted into gas as would be required if used direct as solid fuel. This is because of the greater mechanical efficiency of gas-burning appliances and because the gas can be shut off when the demand ceases.

"In addition to this, there is also conservation of labor because of the fact that gas appliances require much less attention and because the delivery of the coal to the premises and the subsequent handling of the coal and ashes is eliminated.

"BOSTON CONSOLIDATED GAS CO."

Proving to Chain Store Management the Vast Superiority of Gas Over Electricity as the Modern Store Illuminant Brings About Re-equipment of 22-Store System

By a Well Laid Campaign Using the Merits of Lighting Alone, as a Wedge, Welsbach Manager Co-Operating with Gas Companies' Commercial Managers Takes Orders for Replacing Electricity with Gas

The greatest satisfaction in selling anything is to feel when the sale is completed and the fight is won, that the article you have just sold will live up to your most extravagant sales talk; in other words that it will back you up and never fail. That is the feeling that comes when selling gas lighting units and is certainly experienced in this particular case of which we speak by T. W. Colyer, southern salesman for the Welsbach Company.

Mr. Colyer is the type of man who believes in the first part of the old saying, "If you desire anything, and keep wishing for it long enough, you will eventually get it," but knows that quicker results can be obtained by going out and hustling while he waits. Mr. Colyer's wishes are for large orders of lamps from gas companies in his territory. He has proven that his wishes are realized quicker by personally helping the new business manager to look for opportunities of placing the new types of lamps as they come along. It is needless to

Gas Heating Appliance Campaign a Success at Stockton, Cal.

A report from the Western States Gas & Electric Company, a subsidiary of The H. M. Byllesby Company, tells of a recent gas heating appliance campaign in Stockton which resulted in sales of the following: 2,410 sections of cast-iron radiation, 675 sections of Armco iron radiation, 49 floor furnaces, 30 room heaters and 3 Pacific system heaters.

state that this kind of co-operation is keenly appreciated by all commercial managers. They are always appreciative of new suggestions when backed up by the kind of personal service Mr. Colyer renders.

Lining Up the Prospects

When working in a new territory and co-operating with the gas company commercial manager, a systematic campaign is started to look up possible consumers. Trips about town are made in the early evening. Poorly lighted stores are then noted and listed for future work. Proprietors of these stores are seen on the following day, and the facts presented in such a convincing manner that sales are the result.

A Story in Pictures

Among the gas-lighting store sales reports from the new business managers of several cities is a particularly interesting one from Jacksonville, Fla., because the photographs tell the whole story. These photos are reproduced without retouching, and therefore clearly show the most convincing gas-lighting argument—that is, well-distributed light without glare.

Fig. 1, which was taken before the gas lights were installed, shows that the glaring electric lamps are responsible for the sharp contrasts of black and white. Note the dark ceilings, dark spaces under gallery, uneven illumination, absence of detail of goods displayed on shelves and showcases, poor illumination, unpleasant effect on the eyes.

Fig. 2, taken also at night, but after the installation of the gas lamps, shows how diffused semi-indirect illumination smooths out the hard contrasts; illumination is good on goods displayed, all glare eliminated, all parts of store easily and comfortably seen; the buyer being attracted, he is not conscious of the light source, he sees rather the goods on display. Note the detail on the ceiling, which in the electric photograph is entirely lost.

How the Business Was Secured

The fixture used in this Jacksonville installation was the No. 1682 Welsbach "Cone" semi-indirect. The partial payment price of $15 was agreed upon, terms $2.50 with the order and balance to be paid in installments of $2.50, piping to be paid for by the consumer.

SEMI-INDIRECT FIXTURE USED IN JACKSONVILLE, FLA., INSTALLATION

The "Before and After" store, namely, one of the Whiddon Cash Stores, is an illustration of how proprietors are ready to listen to the facts when backed up by proof. Permission was secured from the management to equip one of their stores as a sample to enable the management to see for themselves the many benefits of the new system of gas lighting. That they were convinced is evidenced by the fact that orders were given to similarly equip all of their twenty-two stores. Stores of this character are desirable consumers, on account of their long hours' use of light.

The amount of light required to produce satisfactory illumination by semi-indirect lighting is produced with gas at the least cost and within the reach of all. Sooner or later the well lighted, and attractively lighted store draws the business. Many people go into such places deliberately knowing they will find more wide-awake service and better goods. Others go in merely attracted by the comfortable, inviting illumination of the place.

Malden and Melrose Gas Company Will Help Hospitals Over Coal Shortage Period

Malden is down to the bone on coal. Not a ton has been received in the city in the past forty-eight hours, and the Malden Hospital, with little more than a day's supply, has called upon the Malden (Mass.) & Melrose Gas Light Company for help. The company has responded, and will furnish enough to heat the hospital and also the contagious hospital, but will be unable to help out any of the industrial plants.

Utilities Giving Their Best Aid to Conservation Order

An admirable spirit has been maintained generally throughout the country regarding the Garfield conservation order, and the gas and electric companies have done their part well. Herewith is reproduced a type of service ad inserted by the Rochester (N. Y.) Railway Light Company in an effort to help their consumers, industrial and otherwise:

American Citizens Will Obey the Order

Because hospitals, charitable institutions, municipal lighting, etc., are not affected by this order, gas, electricity and steam will be on our lines as heretofore. If you are in doubt as to how the order affects your business, 'phone "Bell, Main 3960, or Home, Stone 3960" and ask for any of the following representatives of this company:

R. M. Searle	E. L. Wilder
J. T. Hutchings	J. P. MacSweeney
H. Russell	E. C. Scobell
T. H. Yawger	F. W. Fisher
I. Lundgaard	C. A. Tucker
	C. G. Durfee

Any of these men will gladly conserve your time by securing for you a ruling from the local fuel administrator.

Orders for the shutting off of light, heat or of power resulting from failure to obey the new order will be executed promptly by this Company.

Our Attitude

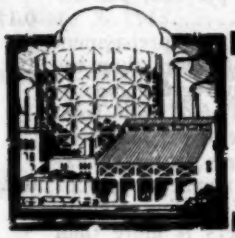
The order has been issued to relieve present suffering and prevent still greater distress.

These conditions have been brought about by the war which must be won.

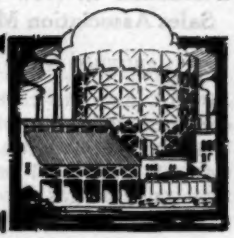
The order means financial loss to all—This is our opportunity to prove that we are the first of all American Citizens.

Let's Do Our Duty Cheerfully

The Chicago Heights Gas Company, of Chicago Heights, Ill., on Jan. 29 filed a petition with the Illinois Public Utilities Commission asking permission to increase its rates for gas service 20 cents per thousand cubic feet. The present rate of this company is $1 per thousand feet and the minimum service bill is 50 cents.



NEWS OF THE GAS INDUSTRY



California Companies Seek Rate Increase

That a rate of $1.10 per 1,000 cu. ft. for gas is fair, but that $1.36, which both the Citrus Belt Gas Company and the Southern California Gas Company will claim in the hearing before the State Railroad Commission, is exorbitant, will be the contention of the city of San Bernardino, Cal., as a result of a month's probe of gas plant values and operating expenses, conducted by City Attorney William Guthrie and Assistant City Engineer W. P. Lowe. The gas corporations are seeking an increase due to the advance in the price of oil, it is declared. In 1913, when the Superior Court held that a rate of $1 returned a fair per cent of profit, the price of oil was 70 cents per barrel. Now it is $1.52.

Higher Rates for Jenkintown, Pa.

The Philadelphia Suburban Gas & Electric Company has filed with the public service commission a new schedule of rates, effective Feb. 20, for its Jenkintown division. This rate affects Jenkintown, Rockledge, Hatboro, Ambler, North Wales, Lansdale, Hatfield, Souderton, Telford, West Telford and surrounding territory.

The tariff provides for an increase in the minimum charge for regular meters from 50 cents net to 70 cents net per month, and an advance of from 10 cents to 20 cents per 1,000 cu. ft. in the unit rates charged for gas consumed. The tariff contains the following schedule of rates.

Minimum 500 cu. ft., 70 cents net; first 5,000 cu. ft., $1.40 net per 1,000; second 5,000 cu. ft., $1.25 net; third 5,000 cu. ft., $1.10 net; next 25,000 cu. ft., $1 net; all over 40,000 cu. ft., 90 cents net. Other changes contained in the new tariff include: Prepayment meters and a monthly service charge of 25 cents, in addition to payments for gas consumed at $1.30 per 1,000 cu. ft. net

Short-term or temporary service for terms less than one year a payment of $1 in advance for each setting and removal of meter shall be made, in addition to the scheduled rates for gas consumed.

Seasonal service: A new rate is established for contracts for the eight months' season between Sept. 1 and May 1, in which a service charge and minimum of $6 per month is to be paid, which shall include 5,000 cu. ft. of gas, and all over 5,000 cu. ft. to be charged at the rate of 70 cents net per 1,000 cu. ft.

Augusta (Ga.) Company Files Petition for Rate Increase

The Gas Light Company, of Augusta, Ga., has filed application with the Georgia Railroad Commission for permission to make a general increase in its rates, applicable to all consumers, of 15 cents per 1,000 cu. ft. of gas. The case was to be heard Feb. 8, and the company was to serve a copy of the petition and all exhibits on the Mayor of Augusta and to publish notice of the hearing in the newspapers so that all parties interested could appear at the hearing.

The application to the commission states that the entire matter has been under discussion between the city officials of Augusta and the Gas Light Company, has been agreed upon and no opposition is expected.

Increase Without Protest in West Virginia

The Public Service Commission of West Virginia allowed the petitions of the Martinsburg Gas Company and Charles Town Gas & Water Company for authority to increase their rates for artificial gas. The increase amounted to about 25 per cent. No protest to the change in rates had been made to the commission, it was said.

THE PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS, in an order entered by the public utilities commission on Feb. 1, was authorized to issue $2,667,000 of gold bonds.

Chicago Company Wins and Loses in Rate Case—Hearing Granted but Increase Suspended

By LOUIS RESNICK
Chicago Correspondent

The Peoples Gas Light & Coke Company, of Chicago, won a point and lost a point in its fight for an emergency increase in rates when the Public Utilities Commission of Illinois, on Jan. 31, set Feb. 26 as the date for a hearing on the gas company's petition, and at the same time suspended the proposed increase until June 16, 1918.

The company lost by this ruling, inasmuch as it had hoped for an immediate increase, because of the extraordinary conditions confronting it. It scored a point in light of the fact that Donald R. Richberg, attorney for Chicago in all gas matters, had attempted to have the gas company's request for increased rates dismissed without a hearing.

The gas company is asking an increase of 22 per cent, which would increase the present average rate from 69 to 84 cents. The hearings on the gas company's petition will be held in Chicago, and it is apparent that the case will revolve around the right of the State utilities commission to interfere in an existing contract between the city and the gas company. There are further indications that the city will question the right of the State body to fix gas rates in Chicago, claiming that such power was delegated to the city by State laws, which have never been repealed.

That the city is determined to do everything possible to prevent the gas company from obtaining the increased rates is evident. Indications are, also, that the company's plea will be opposed by the State as well as the city, for Attorney General Brundage of Illinois has declared that his office would enter the controversy as "the representative of the people." A conference already has been held between Attorney Richberg, for Chi-

(*Continued on page* 141)

Discussion at New England Gas Sales Association Meeting, etc.

(*Continued from page* 136)

$101.78, and the cost of repairing damaged meters for which collection could not be made was $38.01, or a total of 2/100 of 1 per cent of the total sales of gas through the prepayment meters.

During this same period our losses from uncollectible bills registered on regular meters were $803.60, or 23/100 of 1 per cent of the total sales of gas through regular meter.

The losses which come from bad coins and slugs in Pittsfield are almost negligible. When anything of this kind is found, the meter reader at once asks the consumer to make it good; he also notes the fact upon his meter slip, and when this reaches the office a letter is sent out containing a caution against its recurrence. It is much easier to stop this in its incipient stage than when the habit has become common or general. The losses which come from dishonest employees, and the necessity of eternal vigilance, is another troublesome feature of the prepayment meter.

Our meter readers are bonded, but during the past nine years we have had three cases of stealing by meter readers, the amounts stolen having subsequently been made good. A fairly accurate check can be kept upon them by watching the individual debit balance on the ledger and by changing the routes at irregular intervals and keeping a record of the same for comparison if necessary.

We had in use on Jan. 1, 1918, 10,724 meters, of which 2,148, or 20 per cent, were of the regular type, and 8,576, or 80 per cent, were of the prepayment type. For the year ending June 30, 1917, we sold through three and five light regular meters an average of 3,590 ft., and through three and five light prepayment meters an average of 17,406 ft.

Comparative Cost of Installation, Maintenance and Operation

In comparing the cost of using the two types of meters a number of factors must be considered. Original cost, interest, depreciation, repairs, cost of indexing, bookkeeping, making and delivering bills, collection and losses. The actual figures for most of these items are readily available, but we have never kept a separate account as between the two types of meters for either repairs or office expense, and in making a comparative statement of costs these items have been estimated.

The prepayment meters show a higher original cost and a larger expense for interest, depreciation, repairs, cost of indexing and actual bookkeeping work, while the regular meter has higher cost for cashier wages, making and delivering bills, collections and losses.

In addition to the items enumerated above, there are other factors which must be taken into account. In common with most companies, we set our prepayment meters at the net price, while the bills for regular meters are rendered at the gross rate with a discount for prompt payment.

A certain number of consumers neglect to pay their bills within the discount period, and the discount thus lost by the consumer increases the net income of the company by such an amount. At Pittsfield, for a period of five years, this amounted to $2,670.99, or 77/100 of 1 per cent of total sales through regular meters, and if the same percentage had applied to the gas sold through prepayment meters our net income from this item would have been increased in five years by $4,340.50, or an average of $868.11 per year, or $0.127 per meter per year.

We also find in Pittsfield, and I presume the condition prevails generally, that prepayment meter consumers move rather freely from house to house without notifying the company, and that a good many meters are kept under names of persons who have long since been succeeded by other tenants. The net result from a financial standpoint is that the cost of changing and transferring meters is lessened and should be credited in favor of the prepayment meter.

If our prepayment meters were all regular meters, it is fair to assume that at least the same percentage would continue and the cost reduced to a basis of per meter per year would be $0.095.

Using the actual figures available for all these various items, together with an estimate for the balance, and we have the following comparison:

A five-light prepayment costs approximately $3.50 more than a five-light regular meter.	
The interest on the extra cost at 5 per cent per annum is.	$0.175
The depreciation on the extra cost at 5 per cent per annum is.....	0.175
The repairs on prepayment meters cost more than the repairs on regular meters, and an estimate made from our meter department accounts gives an added expense per meter per year of	0.12
The cost of reading prepayment meters is more than that of regular meters, our figures as given above being	0.069
Net difference in cash caused by discounts lost and credited to regular meter amount as given in detail above per meter per year.....	0.127
Gross extra cost of prepayment meters per meter per year	$0.666

Our same bookkeeping force handles both regular and prepayment accounts, and the expenses are not divided. The cost of bookkeeping for prepayment accounts would, perhaps, offset the cost of bookkeeping for regular meters plus the wages of cashier, but we would still have gross extra costs for regular meters of printing bills, addressograph, making bills, envelopes, postage and delivery postage on returned receipted bills, collections of delinquent accounts and losses from unpaid bills. The summary of extra costs for regular meters would be as follows:

Office expense, postage stationery, collections, etc., per meter per year.....	$0.449
The losses from the two types of meters as taken from our books and reduced to a basis of per meter per year shows a difference in favor of the prepayment meter of.....	0.034
Cost of additional changes in number of meters as above.	0.095
	$0.578
Leaving net additional cost of using prepayment meters per year	$0.088

On this basis our 8,576 prepayment meters are costing us $854.69 more than would the same number of regular meters.

General Comments

When we consider the comparative figures as given herein for the two types of meters, we find that prepayment meters seem to show:

1. A smaller output per meter.

(*Cnotinued on page* 142)

Chicago Company Wins and Loses in Rate Case, etc.

(*Continued from page* 139)

cago, and James H. Wilkerson, first assistant to the Attorney General.

The city of Chicago has never officially recognized the State utilities commission as a body that has control over the public utilities of Chicago. Such recognition, because of the establishment of the State's commission's right to regulate gas rates in Chicago, would nullify most of the city's contentions in the pending suit against the gas company for a refund of approximately $10,000,000. It is therefore safe to assume that the gas company's request for higher rates will revive the battle between the city and the State for the right of regulating Chicago's utilities.

In a statement to the council committee which engaged him, Attorney Richberg made the flat declaration that the State utilities commission is without power to fix gas rates in Chicago. This power, he claims, was vested alone in the city council.

In La Salle Street, the Wall Street of Chicago, there is, however, a different point of view. Big financiers on the Street are making the positive prediction that the company will win its fight for increased rates. That their confidence is real is indicated by the fact that the gas company's stock has jumped from 35 to 45 since the application for increased rates was filed.

Nor is this confidence of La Salle Street unfounded. For a member of the State utilities commission, when asked by a Chicago newspaper for his opinion with reference to the authority of the commission to change rates set by the city of Chicago, is said to have replied by pointing to the last paragraph of the public utility commission's order authorizing the gas company to put into effect the rates agreed on Aug. 1 last with the city. The paragraph reads as follows:

"The commission, as a part of this order, reserves the right, either upon its own motion or on complaint, to revise, amend or annul any of the terms or provisions of the said amended schedule of rates or rules and regulations as above set forth, or to make any other or further order as may be necessary in the premises, and for that purpose retains jurisdiction of the matter herein."

Service Charge Asked for by Public Service Gas Company of New Jersey

The right to collect a fee of 25 cents a month from all gas consumers as a service charge is being sought by the Public Service Corporation of New Jersey. The applications were made to the State Board of Public Utility Commissioners by the Public Service Electric Company and the Public Service Gas Company, respectively, Tuesday, Feb. 5, 1918.

The Public Service furnishes electricity to consumers in 188 of the State's municipalities, and either electricity or gas in thirteen counties, as follows: Essex, Hudson, Bergen, Passaic, Union, Middlesex, Somerset, Monmouth, Mercer, Burlington, Camden, Gloucester and Morris. In all of the counties, with the exception of Morris, which takes only gas, it serves electricity, while in Monmouth there is no gas service.

McCarter's Statement

The statement of Mr. McCarter follows:

"Because of the steadily increasing cost of labor, fuel and all kinds of material which enter into the production and distribution of electrical energy and the manufacture and distribution of gas, Public Service finds it necessary to secure additional revenue if it is to continue serving the great bulk of the people of New Jersey in the same efficient manner that it has in the past.

"Conditions have been growing more burdensome each month since the war began. Prices have been advancing beyond all precedents and there is no indication of a let up. That every other business has felt the effect of the conditions which the war has brought about is reflected in the higher prices which people must pay for all kinds of commodities.

"Until recently public utilities have been an exception to the general rule. Their production costs have been going up, but their selling rates have been fixed and they have been compelled to bear all of the additional burdens that have been imposed. Unlike other businesses, they have not been able to share these burdens with the public. The unfairness of such a situation has been so obvious that during the last few months hundreds of utility companies throughout the country have been granted relief in the form of readjusted rates by the regulatory bodies of the several States.

"Public Service Gas Company and Public Service Electric Company have up to the present maintained their pre-war rates, but the time has come when they must have more income if they are to properly perform the functions for which they were created.

"As stated in the companies' advertised notices of their proposed applications there is no intention to ask for any increase in the 90-cent rate for gas or the 10-cent rate for electric current. The only charge sought in the gas rate will be a small readiness to serve charge of 25 cents per month, and the only difference in the electric rates will be those applicable to power users. Lighting customers, including street lighting, will not be affected.

Natural Gas Rates Raised in Proposed Ordinance

An increase of 2 cents a thousand feet for natural gas supplied to the domestic consumers of Fort Smith, Ark., by the Fort Smith Light & Traction Company is permitted by an ordinance unanimously introduced at the meeting of the city commissioners recently, and was read twice and slated for final passage on Jan. 31. The charter of the city requires ordinances of the nature to lay on the table for one week. The company recently increased the price from 15 to 25 cents per 1,000 ft.

The commissioners had prepared a table on the 15-cent maximum rate, based on the amount of gas sold during the year 1917, but that was abandoned, as it did not substantiate their claims. The table brought into the discussion permitted advances of nearly 12 per cent on the maximum rate, the one that applies to the citizens using gas in the homes, and 50 per cent on the minimum rate, which applies only to industries that make use of extremely large quantities each month.

The rates as fixed in the ordinance are as follows:

First 50,000 cu. ft. per month, 17 cents.

Next 50,000 cu. ft. per month, 16 cents.

Next 100,000 cu. ft. per month, 15 cents.

Next 100,000 cu. ft. per month, 14 cents.

Next 100,000 cu. ft. per month, 13 cents.

(*Continued on page* 144)

Discussion at New England Gas Sales Association Meeting, etc.

(*Continued from page* 140)

2. A somewhat higher cost.

And we realize at once that the use of prepayment meters is not justified unless a further analysis of actual conditions can be made which will offset these figures.

In considering this phase of the matter, let us first of all take up the question of output. It is true that practically all tabulations of output show a smaller consumption of gas through the prepayment meter than through the regular. This does not necessarily mean that the same consumer will use less gas, but rather that, in a general way, the people who are using regular meters are a different class of consumers from those who are using the prepayment type and that they are naturally much better consumers.

I became convinced of this fact a number of years ago, and had comparisons made on a *yearly* basis of the same customer when he chanced to change from one type of meter to the other, and found that it made no appreciable difference which kind of meter he was using.

The regular meters in Pittsfield are installed largely in stores, saloons, poolrooms, bowling alleys, restaurants and in those houses where all expenses are relatively large and where there is less attention paid to rigid economy. I believe that I am correct in saying that, notwithstanding the comparative figures as to output, the type of meter has really but little bearing upon the actual amount of gas used by any given consumer, and that it is a question of the consumer himself rather than one of any particular type of meter.

We still have left the question of "a somewhat higher cost."

All of the computations which I have made are based upon the supposition that the same ratio of expense would prevail for regular meters if all of our prepayment meters were of the regular type. These are the only actual figures which we have to use, but I believe that in actual practice it might be necessary to modify them somewhat—that the class of consumers now using prepayments would cause somewhat higher costs for collections than the figures of our present regular consumers. I believe that the class of people who are using prepayments are more likely to move from house to house, and that in the aggregate they would do so more often than do our present regular consumers, and that this would cause additional expense.

But leaving these conjectures aside, I believe that the use of the prepayment, even at a slightly higher cost, is justified from the standpoint of increased volume of business and that of "intensifying output."

There would seem to be no question but that a larger number of consumers can be secured on any given main if prepayment meters are used to some extent, at least, because a certain proportion of the people cannot or will not pay a deposit to secure a regular meter, and might have difficulty in paying the accumulated consumption of a monthly bill, while they can put a quarter into the meter from time to time and become accustomed to making provision for it.

The successful manufacturer of to-day is working as never before for increased production, and the consequent reduction of overhead expense.

The reasons which make this advantageous to other producers apply with equal force to the gas manufacturer. Given an adequate works and distribution system, together with an organization to conduct the same, and more net profit can be made if every possible consumer on existing mains is an actual consumer than if only 50 or 60 or 75 per cent of them are burning gas.

Is not the prepayment meter more or less in accord with the spirit of the times, especially as pertains to the largest proportion of our consumers? A goodly portion of them are among the wage-earning class; their wages come in on a certain day of each week and they have become accustomed to paying it out in small amounts, both for pleasure and necessities.

The business of the gas company has changed within the memory of most of us. With high prices and comparatively few customers, we sold gas to those people who could afford the luxuries, but with the decrease in price and increase in number and kind of appliances, we have had an ever widening list of consumers, and the prepayment meter is in keeping with and a part of this change that has been taking place.

Mr. Woodhead opened the discussion by asking two questions: (1) In companies where a minimum charge is made, how is it assessed on prepayment meters? (2) Are any companies setting prepay meters on automatic water heaters?

Mr. Crafts said that there was no minimum charge made in Pittsfield. Instead of making a charge for this class of service, every effort was made to bring such a consumer into a profitable class by increasing the consumption. He felt that we should give more attention to the developing of the consumption of the unprofitable consumer by increasing the use of their present appliances and the sale of others.

No prepayment meters are set on automatic water heaters in Pittsfield.

Mr. Gould said that he had heard that Woonsocket had removed over 3,000 prepay meters, and he was sorry Mr. Pettingell was not present to tell us why.

Mr. Buckminster said that Fall River had only about 1,600 prepayment meters in use. The service regulations tended toward running service in a location unfavorable to the prepayment meter.

An Aid to Conservation

Mr. Smith said that almost one-third of the Old Colony Gas Company meters are of the prepayment type. A minimum charge is made to bring up the account to $6 per year. The prepayment meters were originally installed for consumers who were delinquent in their accounts and were set at 25 cents a thousand over the gross rate. All prepayment meters are set at this rate, and the excess of 25 cents a thousand, less the amount needed, if any, to make up the minimum is refunded at the end of the year. This also allows for the collection of any difference which might exist between the meter reading and the coin device. A minimum deposit of $3 is collected on all regular meter orders and of $1.50 on all prepayment.

Mr. Gifford said that frequent moving of consumers was one of East Boston's difficulties. All meters are changed when the consumer moves, and a $1 deposit is collected on all prepayment meter orders. He thought that the use of the prepayment meter caused a decrease in the consumption.

Mr. Gould said that in their companies the percentage of increased consumption per meter was greater on the prepayment than the regular.

Mr. Smart said that Portland had about 14,000 meters in use. About a year ago a rule was made to ask for a $2.50 deposit on a prepayment meter order. By this deposit the great increase in the use of the prepayment type was checked and now only about 6,000 were in use. He felt sure that by the use of the prepayment meter a great many consumers were secured which would not have been if only the regular type was used.

Mr. Gould asked if the doing away of the deposit was not one of the strong points in favor of the prepayment type. In asking for a deposit are we not going back to one of the difficulties in the use of the regular meter?

Mr. Smart said that this was obviated by carefully showing the consumer the need of a deposit because of the greater risk.

Charles A. Learned, of Meriden, Conn., related a story showing that for some people it was easier to pay 25 cents per week than $1 a month, and said that the same principle works out in the prepayment meter. It is easier to pay for the gas as used than to pay for it monthly. Nearly 75 per cent of Meriden's meters are prepayment, and they have built up a large business with a class of consumers almost impossible to reach otherwise.

Mr. Gould spoke of the enormous business built up on the installment principle, and asked if the prepayment meter did not work the same way.

Mr. Tudbury said that Salem had about 13,000 meters in use, of which about 9,000 were prepays. The losses on the prepays were less than the uncollectible accounts on the regular meters. Salem collects the minimum charge by asking for the difference at the time the meter is collected.

Spending in Small Sums

Mr. Morrison, of Lynn, told a story about a woman who went to the bank for new quarters. When asked why they must be new, she said that she got more gas from her prepayment meter if she used new quarters. He thought that the principle that it is easier to spend the same amount of money in small sums applied to the prepayment meter.

Mr. Smith said that we were spending money to teach our consumers not to waste gas. We were preaching the use of more efficient burners and appliances. Does not the prepayment meter aid in the prevention of waste and the making of a better satisfied consumer?

Mr. Crafts said that where the consumer paid for the gas as it was used, he was better satisfied, as he remembered its use. When he paid for it at the end of the month often the service was forgotten.

Mr. Gould told of a clothing concern which complained every month of a $9 or $10 bill. Since a prepayment has been installed, their consumption has increased and there has been no complaint.

Mr. Crafts was sure that the prepayment meter was best for a certain class of people, and that through it we could sell more gas.

J. A. Gould, of the Boston Consolidated, quoted the old saying that it is hard to pay for a dead horse. He thought we did not give sufficient consideration to the difficulty in collecting from some classes of consumers without the use of the prepayment meter.

Mr. Thompson asked if any company had tried to sell appliances through the prepayment meter.

Mr. Gould said that one of their companies had tried it out with poor success.

Mr. Barnes asked if the prepay type was becoming more popular.

Harry Norton said that 40 per cent of the meters sold by the Tufts Meter Works last year were of the prepay type.

Mr. Jennings said that Framingham made a charge, not a deposit, of $1 for installing a prepayment meter. This is refunded when the account is closed if the meter is returned in good condition. This charge obviated the interest required of a deposit and cut down the requests for prepays.

Mr. Woodhead asked how the sliding scale was handled on prepay meters at Pittsfield.

Mr. Crafts said that a few restaurants used a prepayment meter and came under the sliding scale. These received a refund at the end of the year as discount. Pittsfield changes all of its meters in between six and seven years of use.

The meeting was then adjourned.

Illinois Commission Busy with Many Gas Hearings

At least a dozen hearings affecting gas companies were held by the Public Utilities Commission of Illinois last week. In four cases increased rates for gas service were asked, three hearings were on complaints regarding service or rates, and others were concerned principally with financial matters.

The hearings on proposals for increased rates were held on the petitions of the Canton Gas & Electric Company, which sought an increase for service in Canton, Ill., and the Central Illinois Public Service Company, which asked for an advance of rates for general gas service in the districts of Charleston, Taylorville and Pana, Ill.

A hearing was also held on the application of the Central Illinois Public Service Company for authority to deliver a general mortgage on their property to secure the issue of $500,000 in 6 per cent general mortgage bonds.

Final Reduction in Standard of Chicago Gas Will be Made When Weather Moderates

Although the city ordinance authorized the Peoples Gas Light & Coke Company, of Chicago, to make the final reduction in the quality of its gas on Feb. 1, this year, John P. Garner, commissioner of public service of Chicago, has been notified that the reduction will not be made until after the cold weather.

By the terms of the ordinance passed last year the company on Feb. 1 had the right to decrease the candle-power of its gas to 9, but tests made by the city on that date showed that the company was still giving a gas whose candle-power varied between 12 and 15, according to Commissioner Garner. The company decided not to risk the chance of the gas freezing during the severe cold weather now prevailing at Chicago, especially in view of the fact that many homes short of coal are now using gas extensively for heating purposes.

Goshen, Ind., Company Asks Increase at Recent Hearing

The hearing of the Goshen (Ind.) Gas Company for an increase in rates was to be heard before the public service commission at Indianapolis Jan. 29. The city is represented by the attorney for the Municipal League of Indiana, Mayor Troyer and former Mayor Spohn.

Natural Gas Rates Raised in Proposed Ordinance

(*Continued from page* 141)

Next 600,000 cu. ft. per month, 12 cents.

Next 1,000,000 cu. ft. per month, 10 cents.

Next 1,500,000 cu. ft. per month, 8 cents.

Next 2,000,000 cu. ft. per month, 7 cents.

Consumption in excess of above per month, 6 cents.

These figures show a profit of 8.06 per cent to the company after deducting the operating expense and 5 per cent depreciation, based on the auditor's report of a half-million investment in the distribution service.

The report made by Auditor Gilbertson shows a total consumption of 1,704,583,100 cu. ft. during the year covered by the audit, and of this 772,975,000 was supplied at the highest rate to domestic consumers and 658,688,000 to industries that consumed such large quantities that they were entitled to the 4-cent rate that was in force at that time. The consumers at the intermediate rates used comparatively small amounts, ranging from 7,447,000 to 65,130,000 cu. ft.

The ordinance, which received the vote of all of the commissioners on the two readings, places no penalty on the company for charging in excess of the rates with the exception of the maximum, leaving the traction company in position to change the sliding scale at will.

Saw Factory Consumption Increased Six Times by Successful Industrial Installation

"In a plant in the Western territory, engaged in the manufacture of saws, we made, a short time ago, an installation then regarded as purely experimental by the owners. They found it difficult to believe that coal, coke and oil, the fuels approved in the industry, could be successfully supplanted," points out H. H. Clark in the last issue of *Public Service Lumen*, published by the Public Service Company of Northern Illinois. "One furnace only was converted for gas. The general operation of handling the blank through its different stages, ending in the completed saw, is in reality a delicate one. But gas, it was found, expedited and assured it in the sense that there was a marked decrease in spoiled material. As a result of the experience six furnaces are now being fitted up for gas in the plant.

"In another plant, also in the Western Division, the employment of gas in place of other fuels was looked upon as revolutionary in the industry involved—the manufacture of roofing materials. A very wide interest was created, even to the extent of inspiring manufacturers in other cities to visit the plant. From the beginning gas achieved perfect success in its work. The all around higher efficiency attained was accompanied by a lessening in costs. The initial installation, consuming 1,000,000 cu. ft. daily, has been in operation nearly a year. The entire plant is now being equipped for fuel gas.

"At this plant we have put in service an improved burner, which the test shows is effective. A refractory element is used in it as a substitute for the usual metallic material. The difficulties of oxidization and carbonizing manifest in ordinary burners are overcome. The cost of the burner is considerably above the ordinary kinds, but its merits are very marked.

"The extraordinary rapidity with which gas has established its case as a fuel in general manufacturing, has developed the need of improvements in appliances, particularly burners. Except for the disturbance which war has made and the interruption of various meetings where ideas are exchanged, there is no doubt the problem would have received more attention from the different gas associations. They have not been blind to it, though, nor has the necessity aforesaid failed to arouse the research people. But much remains to be done in the direction which is implied."

Rate Increase Effective Feb. 1 at Ames, Iowa

By action of the city council at an adjourned meeting, the Iowa Public Service Company was granted permission to increase its gas rate in the city of Ames, the increase to become effective Feb. 1. The new charge will be $1.75 per 1,000 cu. ft., instead of the present rate of $1.50. The monthly average of 550 B.t.u. of heat must be maintained.

Personal Notes

OLIVER W. ADAMS, superintendent of the Municipal Gas Works, of Holyoke, Mass., recently resigned to go with the Brockton (Mass.) Gas Light Company as superintendent. He is a member of many Holyoke societies and fraternal orders.

THE BLUEFIELD (W. VA.) GAS & POWER COMPANY, at the recent annual meeting of its stockholders, held in the offices of the company in the Kelly and Boyer Building, elected the following officers: Frank T. Horner, president; A. C. Howard and P. J. Kelly, vice-presidents; E. T. Tyree, treasurer; L. Irvin Pollitt, secretary and general manager. The following directors were elected: W. H. Thomas, P. J. Kelly, E. T. Tyree, Frank T. Horner, E. G. Cornette, A. C. Howard and L. Irvin Pollitt.

THE TAMPA (FLA.) GAS COMPANY, at its annual meeting, held Jan. 15, elected the following officers: John Gribbel, president; David J. Collins, vice-president and treasurer; Roscoe Nettles, secretary and manager; J. D. Shattuck, consulting engineer, and Peter O. Knight, attorney; also a board of directors composed of John Gribbel, David J. Collins and Peter O. Knight.

J. H. PARDEE, president of The J. G. White Management Corporation, New York, and J. P. RIPLEY, engineer, have returned to New York from a general inspection of the Manila Electric Railroad & Light Company, and other interests in the Philippine Islands operated by The J. G. White Management Corporation.

THE OMAHA (NEB.) GAS COMPANY, at its annual directors' meeting, held Jan. 21, re-elected the following officers: Frank T. Hamilton, president; G. W. Clabaugh, vice-president and secretary; Lewis Lillie, treasurer; I. W. Morris and L. W. Weymuller assistant secretaries and assistant treasurers.

FRANK CARDER has been appointed manager of the Oklahoma Gas & Electric Company, Norman, Okla., division, succeeding W. P. Jones, who resigned.

New Franchise Ordinance Before Little Rock Council

A tentative ordinance for a franchise to pipe natural gas from the Monroe, La., field to the city of Little Rock, Ark., was introduced in the city council recently, and referred to the ordinance and utilities committees, the city engineer, city attorney and Mayor Taylor, who were to meet the next day to consider the proposition and hear details from the parties interested.

The introduction of the tentative ordinance followed the reading of a communication from Louis Lock, president of the Louisiana-Arkansas Oil & Development Company, and a personal statement of the aims of the company by Mr. Lock and Attorney Carl H. McHenry, of Monroe, who represented the company. Briefly stated, the company asked for a forty-year franchise. It proposed to lay an 8-in. or larger main, if necessary, to carry an adequate supply, and to deposit a bond of $20,000 to have gas at the city limits within twelve months after the franchise becomes effective. The company agreed to pay the city $2,000 for the first year of the life of the franchise, $3,000 for the second, $4,000 for the third, and $5,000 thereafter as long as natural gas is supplied.

$379,226 Added to Louisville Company's Assessment

The city board of equalization of Louisville, Ky., increased the assessment of the Louisville Gas & Electric Company $379,226 over that of last year.

The company's assessment for 1918 was fixed at $6,791,131.90, against an assessment of $6,435,029 for the year 1917. The increase affects personal and real estate as well as the franchise.

Though members of the board were unable to say how large the increase in assessment of all property in the city over last year is, the statement was made that such increase will be shown when the figures are compiled. It will require at least ten days to definitely determine the figures.

THE PITTSFIELD GAS COMPANY, of Cleveland, Ohio, was recently authorized to raise its capital stock from $25,000 to $50,000.

Government Recommendations on Burning Bituminous Coal

In order that there shall be the greatest economy in the burning of bituminous coals for heating the different Federal buildings throughout the country, the Bureau of Mines, Department of the Interior, has conducted a series of tests with some of the widely used bituminous coals and has printed recommendations based on these tests. Fortunately, the recommendations will also apply to those having charge of private buildings and apartment houses.

The results of the tests are printed in Technical Paper 180, "Firing Bituminous Coals in Large House-Heating Boilers," by S. B. Flagg. The recommendations on how to burn bituminous coals economically in these large house-heating boilers are as follows:

1. In burning bituminous coals in large house-heating boilers the fuel bed should not be seriously disturbed until the coal has become well coked; that is, until the gassy part of the coal has been largely driven off.

2. Both caking and non-caking types of coal may be used satisfactorily in boilers of this type if properly handled.

3. The presence of a moderate proportion of screenings mixed with the lump coal causes the fresh charge of coal to heat more gradually and the emission of smoke is kept down more easily. Therefore such a proportion of screenings is an advantage.

4. Increasing the proportion of screenings in the coal necessitates the use of a stronger draft in order to carry the same load. Smaller firing charges must also be used and more frequent attention given. The tendency of caking coals to cake is increased, and this also means that the fire must have more frequent attention.

5. One large charge of coal fired by the spreading method will result in a longer emission of dense smoke than the total emission of such smoke from two charges of half the size fired some time apart and by the alternate method.

6. With some coals, moderate charges fired by the alternate method necessitate less frequent attention to the heater than larger charges fired by the spreading method. Caking coals having a considerable proportion of fine coal or screenings are usually among these. Conversely, a fire will usually require more frequent attention when a lumpy caking coal free from screenings or a non-caking coal is fired in moderate charges by the alternate method.

7. The number of tests made was not large enough to justify conclusions regarding the relative efficiency with which a coal may be burned by the two methods of firing, but the author believes that in actual service over considerable periods better results will be obtained by the alternate method.

8. Frequency of cleaning the fires will be determined by the character of the coal and the rate at which it is burned, but with most coals the fires should be cleaned only once or twice in twenty-four hours in ordinary weather.

9. If the alternate method of firing is employed, the cleaning should be done just before firing the fresh charge, and only one-half of the grate cleaned at a time. Then little or no smoke will result from the cleaning, because the side of the fire on which there is uncoked coal is not disturbed.

10. All three of the coals fired by the alternate method in the tests described were burned at rates corresponding to the heating conditions during the most of the winter, with scarcely any manipulation of the fuel bed except the cleaning of the fires and an occasional leveling just before firing.

11. The average fireman is apt to poke and slice the fire much more than is actually necessary. If a caking coal is used and the caked fuel must be broken up before it is well coked, slice the fire by running a straight bar under the fuel bed and raising it slightly so as to crack the caked mass. Do not stir the bed upside down by raising the bar through the fuel bed, nor break the bed with a bar from the top.

12. If the fuel bed is covered with a charge of fresh fuel in a layer more than 5 in. thick, the new charge, unless it is very free from slack, is apt to have a smothering effect. Then the output of the boiler will be correspondingly decreased and, especially if the spreading method of firing is employed, the mass of fresh coal will

usually have to be broken once or twice before the fire will pick up. Consequently, the maximum firing charge should be not much thicker than 5 in., and for caking coals containing considerable slack it should not be more than 4 in. thick. Of course, when a fire is to be kept banked heavier charges may be used.

13. Do not fire large lumps of coal. Break all lumps into pieces no larger than fist size.

14. Large house-heating boilers do not require an intense draft to meet any reasonable demands for heat if the fuel bed is kept in proper condition, but the draft must be properly controlled.

15. The damper regulator should work freely with changes in steam pressure, and should close the swinging draft opening in the ash-pit door before it starts to open the check draft in the smoke pipe.

16. The doors on the front of the boiler should fit snugly in their seats; special care should be taken to prevent any material wedging between the doors and the front, and thus admitting air when or where it ought to be prevented from entering.

17. Do not allow clinkers to accumulate in the fire or too great a quantity of ashes on the grates. Be careful, however, in shaking the grates not to shake through unburned fuel.

18. In ordinary or severe weather keep an active fuel bed averaging 10 to 12 in. deep. In milder weather the depth of active fuel may be decreased by keeping a layer of ashes on the grate under the live coals.

19. Keep ashes removed from the ash pit.

20. Keep flue surfaces clean by brushing at least once a week.

Copies of this technical paper may be obtained free of charge by addressing the Director of the Bureau of Mines, Washington, D. C.

The American Engineer

Taken from an address given before the Savannah Chapter of the American Association of Engineers, Jan. 26, by A. H. Krom, general secretary American Association of Engineers.

The American engineer is that citizen of the United States who is qualified by training and practice to join with his co-workers to direct organizations and harness natural resources which will crush the greatest menace to Christianity and make the world safe for democracy.

He is the man who will after this war solve the great international problems of making all countries safe and sanitary for their peoples.

He is the man who has for his foundation a broad engineering education that has prepared him to use the natural elements which he has discovered and developed through experiment until to-day the Atlantic and the Pacific are speedways, the air is a highway free from dust and the shortest distance between two points for travel and a line for conversation by telegraph and telephone, the swamps are the best fields for grain, and the hills and mountains are producing untold wealth.

He is the man who recommends the expenditures of millions by his government or by the business men of the country. All industry, either in war or peace, depends upon the engineer for production and operation. Our profession is extremely fortunate to have the opportunity to step in and be the deciding factor in the war which will mean most to civilization for all ages.

The American engineer is the man of the hour.

Construction Notes

Contract for Gas Tank Foundation Soon to be Awarded

The Consolidated Gas, Electric Light & Power Company, of Baltimore, is planning to award the contract for the foundation of the gas tank to be built at St. Helena.

Brockton, Mass., Company Ready to Help Government

If the United States Government desires greater recovery from gas by-products of toluol, the Brockton (Mass.) Gas Light Company will respond to such a request and do its share toward turning out as much toluol as possible. Manager George H. Priest says it is uncertain if such a requisition will be made, but if there seems a possibility of it at any time the company will at once install the equipment by which toluol may be derived from the gas by-products.

Extensive Improvements Being Made at Norfolk, Va.

Work has already begun on some of the improvements for which the City Gas Company, of Norfolk, Va., proposed to spend $150,000. These improvements consist of the installation of a new water gas machine, a new purifying apparatus and the extension of mains. While the greater part of the contract has been awarded to the United Gas Improvement Company, of Philadelphia, some of the work will be done by the City Gas Company's own employees.

"We have already started on some of the work here," said T. Norman Jones, Jr., general manager of the City Gas Company, "but I am unable to give the faintest idea of when the entire program will be completed. Under the present conditions it would be impossible for anybody to say when such work as we have provided for could be finished. There will be no time lost, though, in pushing the work. We expect to have everything in readiness before next winter and be in position to take care of the situation when cold weather sets in again. The improvements will enable us to increase the output and give very much better service. We shall do everything possible to prevent a recurrence of the conditions that have existed this winter."

The officials of the City Gas Company have realized that the present system of manufacturing and distributing gas, and the equipment used for that purpose, has been inadequate during the winter months, and W. A. Allison, a gas engineer of nation-wide reputation, was employed to make a survey of the gas plant and recommend what is needed to meet the needs of this city. The action of the company in awarding the contract for the improvements that will cost $150,000 was the result of his recommendation.